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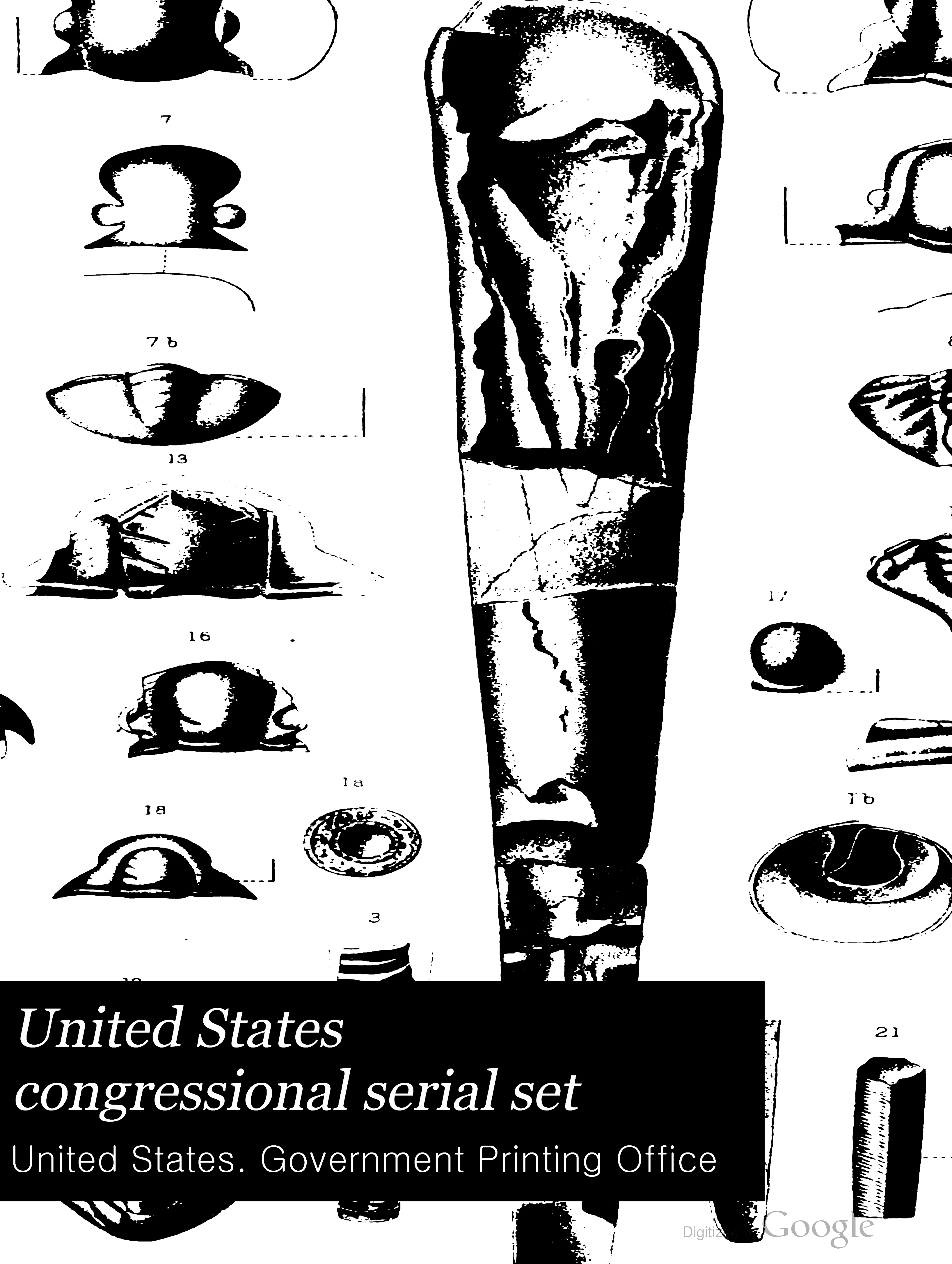

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DEPARTMENT OF THE INTERIOR

MONOGRAPHS

OF THE

UNITED STATES GEOLOGICAL SURVEY

VOLUME VIII

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UNITED STATES GEOLOGICAL SURVEY

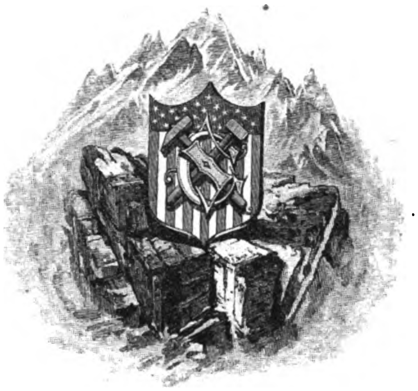
J. W. POWELL DIRECTOR

PALEONTOLOGY

OF

THE EUREKA DISTRICT

By CHARLES DOOLITTLE WALCOTT



WASHINGTON
GOVERNMENT PRINTING OFFICE
1884

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
Washington, D. C., June 1, 1884.

SIR: Herewith I have the honor to transmit a report on the invertebrate fossils of the Paleozoic rocks of the Eureka District, Nevada.

I am greatly indebted to you for the personal interest you have taken in the work and generous facilities given me, both in the field and office, in carrying on the earlier part of this investigation.

I am also under many obligations to Hon. J. W. Powell, Director of the Geological Survey, for the opportunity afforded me to continue and enlarge the work after the completion of the original report.

Very respectfully,

CHARLES D. WALCOTT.

Mr. ARNOLD HAGUE,
Geologist in Charge.

UNITED STATES GEOLOGICAL SURVEY,
New York, June 4, 1884.

SIR: I have the honor to transmit herewith the report of Mr. Charles D. Walcott on the "Paleontology of the Eureka District."

The publication of Mr. Walcott's monograph marks an era in the history of the Paleozoic paleontology of the Far West. Heretofore the collections of fossils obtained have been in most instances small, incomplete, and hastily gathered from more or less widely separated localities. If the species obtained proved sufficient to determine the geologic horizons for the purpose of comparative study, little more was expected.

Now we possess the results of a careful survey of a district with a rich fauna, through 30,000 feet of Paleozoic strata, representing the Cambrian, Silurian, Devonian, and Carboniferous rocks.

Mr. Walcott's intimate knowledge of the geological and structural features of the district lends additional weight to his own special labors. I regard his report as the most important contribution yet made to the invertebrate paleontology of the Basin Ranges, and of great value in its bearings upon the geology of the Cordillera, which under your guidance we are gradually working out.

Very respectfully, your obedient servant,

ARNOLD HAGUE,
Geologist in Charge.

Hon. J. W. POWELL,
Director United States Geological Survey, Washington, D. C.

PREFACE.

This volume includes a report on the fossils collected during the field season of 1880 by the members of the Geological Survey of the Eureka District, transmitted for publication May 1, 1882, and additional observations and descriptions resulting from the study of collections made under the immediate direction of the writer in the summer of 1882. Eleven plates of illustration and nearly double the amount of text originally transmitted have been added, and the character of the report slightly changed. The reader will pardon the slight confusion in the arrangement of the plates resulting from this, and also the difference in the mode of illustration. The system of using wood-cuts is of great advantage, as it offers an opportunity to all for obtaining copies of the original figures by electrotyping. This is the first extended trial of the method for fine, detailed illustration, and is attempted at the special request of Major J. W. Powell, Director of the Survey.

In the preparation of the original report, frequent reference was made to the well-known Hall collection of Paleozoic fossils in the American Museum of Natural History, through the kindness of the curator in charge, Prof. R P. Whitfield, to whom I am indebted for valuable assistance. Prof. James Hall generously gave access to the material he had accumulated for the study of the corals and lamellibranchiate shells of the Devonian, and also aided me in my comparisons between the New York and Nevada specimens. Acknowledgment is due Prof. Samuel Calvin and Dr. J. P. Farnsworth, of the State University of Iowa, for the use of specimens for comparison. The skill and care exercised by Mr. G. B. Simpson in preparing the drawings for plates ix to xx, inclusive, and by Dr. J. C. McConnell for plates i–viii, xxii–xxiv, inclusive, is shown in the plates illustrating this report.

C. D. W.

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PALEONTOLOGY OF THE EUREKA DISTRICT.

BY CHARLES D. WALCOTT.

SUMMARY OF RESULTS.

The general character of the fauna of the Cambrian, Silurian, Devonian, and Carboniferous strata of the Eureka and White Pine Mining Districts of Central Nevada is given in this report more to illustrate the stratigraphic succession and equivalency of the geologic horizons with those described elsewhere than as a detailed monograph of the invertebrate fossils; since, for the latter purpose much more extensive collections are necessary to represent the large fauna of the Paleozoic system of Central Nevada than we have at present.

As an assistant geologist in the field-work, the writer collected most of the fossils *in situ*, and studied their mode of occurrence and stratigraphic relations, thus disposing of an element of uncertainty which frequently arises in the mind of the paleontologist when examining collections from a region unfamiliar to him, and which presents, in the strata of the lesser divisions of its great geologic series of rocks, associations of species unknown elsewhere or an unusual vertical range of individual species. The presence of the Trenton species *Orthis testudinaria* in the upper portion of the lower half of the Pogonip Group in association with the genera Ptychoparia, Dicellocephalus, and Asaphus, is a typical example. Other illustrations of unusual association of species will be given in speaking of the Devonian fauna.

In the lowest fossiliferous stratum of the Cambrian in the District an interesting species of the genus Olenellus, *O. Howelli*, occurs that exhibits several abnormal features of development, and also certain embryonic characters that show the relation of the genus to the genus Paradoxides. Considerable space is given to the description and discussion of this species, and also a plate of outline figures to illustrate its variations and relations to other species. The specific identity of two of the three species of Olenellus, with *O. Gilberti* and *O. Howelli* from Pioche, Nevada, 130 miles distant, and their close resemblance to the species of Olenellus occurring in Vermont and Newfoundland, closely unites the faunas of the widely-separated localities, and aids materially in the correlation of the different groups forming the Cambrian system on the North American continent.

The Lower Cambrian type of the Conocephalidæ is represented by *Ptychoparia Linnarssoni* and *P. Prospectensis;* and the subgeneric groups of the genera usually occurring in the Potsdam Group are prominent in the fauna of the upper portion of the Cambrian. In *Protospongia fenestrata* we have a very simple and peculiar form of silicious sponge that is probably identical with the Cambrian species of St. David's, Wales.

Much remains to be done with the small brachiopods of the Cambrian and Lower Silurian, since from their minute size and the imperfect state of preservation of the specimens collected, correct generic and specific references are very difficult. The one species of the genus Graptolithus in the upper portion of the Pogonip (Quebec) Group is the only trace discovered at this horizon in the Eureka District of a fauna which the writer in 1882 found quite extensively developed in the Piñon Range to the north. The Graptolites from Belmont, Nevada, that were described by Dr. C. A. White and referred by him to the Utica slate horizon of the Trenton Group (Expl. and Surv. West of 100th Merid., vol. iv, part 1, p. 10), are probably from the horizon of the Quebec Group, or the Upper Pogonip of the Eureka section.

The succession in the faunal series from the Olenellus (or Middle Cambrian) fauna, through a large, well-defined fauna of the character of that of the Potsdam Group of New York and the Mississippi Valley, to one that in its assemblage of species combines both Cambrian and Silurian types and passes upward into a fauna comparable to that of the Quebec Group, or the

Calciferous and Chazy Groups, is of special interest. The transition from the Cambrian to the Silurian fauna is very gradual, and such as would occur where there was no marked physical disturbance to influence the faunal change resulting from the natural dying out and development of species or the influx of new species from other areas.

Of the species occurring below the passage beds three are identical with species occurring in the Potsdam sandstone of Wisconsin, viz: *Hyolithes primordialis*, *Dicellocephalus Osceola*, and *Ptychaspis minuta;* one with *Acrotreta gemma* of the Calciferous formation of Newfoundland; and *Ptychoparia Oweni* is a common species of the Potsdam horizon in Montana and Dakota. These specific identifications and the great development of species of the genera *Agnostus*, *Dicellocephalus*, and *Ptychoparia*, in the middle and upper portion of the Cambrian section, furnish abundant evidence upon which to correlate the fauna and the geologic horizon at which it occurs with the Potsdam fauna and formation, as was done by Messrs. Hall and Whitfield (Geol. Expl. Fortieth Par., vol. iv, p. 199, 1877). Of the Potsdam fauna eleven genera and fifteen species continue on into the passage fauna, viz (species of the Potsdam fauna are printed in italics): *Lingulepis Mœra*, *L. minuta*, *Lingula? manticula*, Discina (sp. undt.), *Acrotreta gemma*, Schizambon typicalis, Obolella ambigua, *O. discoidea*, *Leptæna Melita*, Orthis Hamburgensis, O. testudinaria, Triplesia calcifera, Tellinomya ? Hamburgensis, *Agnostus communis*, *A. bidens*, *A. Neon*, Dicellocephalus finalis, D. inexpectans, Ptychoparia ? annectans, *Ptychoparia affinis*, *P. granulosus*, *P. Haguei*, *P. Oweni*, *P. unisulcatus*, *Arethusina Americana*, Amphion (sp. undt.), Barrandia McCoyi, Illænurus Eurekensis, Asaphus Caribouensis.

In the next superior grouping, about midway of the Pogonip Group, all the middle Cambrian genera, with the exception of Orthis and Illænurus, have disappeared, and higher up the genera Receptaculites, Chætetes, Pleurotomaria, Maclurea, Cyphaspis, Bathyurus, and Asaphus carry the fauna up to the summit of the formation where the genera Receptaculites, Ptilodictya, Chætetes, Strophomena, Orthis, Tellinomya, Modiolopsis, Maclurea, Cyrtolites, Orthoceras, Endoceras, Coleoprion, Leperditia, Beyrichia, Amphion, Ceraurus, and Asaphus give it a facies approaching that of the

Lower Trenton and indicating an horizon that is considered to be in a measure the equivalent of that of the Chazy formation of New York and Canada. The fauna of the lower portion of the Pogonip Group corresponds in the same manner to that of the Calciferous sand-rock of the same region. The large number of individuals of the species of Receptaculites, *R. mammillaris* especially, gives the fauna of the upper beds a character that this horizon has not hitherto had. This, united with several of the Trenton species, viz, *Orthis testudinaria*, *O. tricenaria*, *O. perveta*, *Tellinomya contracta*, two species of Modiolopsis allied to Trenton forms, and *Raphistoma Nasoni*, strongly foreshadows the opening of the Trenton period.

The fauna between that of the Pogonip and the Devonian horizon is so meager that the only reference made to it is in the systematic list and in the lists of the geologic report (Geology of the Eureka District). As the determination of a higher Silurian horizon than that of the Trenton-like fauna in the limestone above the quartzite capping the Pogonip Group rested mainly on the presence of the genus Halysites, the opinion of Prof. James Hall was requested as to the generic relations of the specimens that had been referred to Halysites in the field. While he did not say positively that the form represented was Halysites, he expressed the opinion that it was of organic origin, and that he knew of nothing else but Halysites to which it could be referred. This conclusion has since been fully proven by the discovery of fine specimens of *Halysites catenulatus* at the same horizon in the White Pine District, Nevada, associated with specimens in a similar state of preservation as those from Lone Mountain.

The fauna of the Devonian is large and representative, notwithstanding some species have reversed their relative position in the group as they have been known heretofore, and others have a greater vertical range. Among the brachiopods, *Orthis Tulliensis*, of the Tully limestone of New York State, is found at the summit of the Devonian limestone, and *Orthis impressa*, a Chemung species of New York, at the base, associated with eastern Upper Helderberg limestone species; and a variety of *Atrypa reticularis*, characteristic of the Niagara limestone, and unknown heretofore elsewhere, occurs with the former in the upper beds. Among the corals, *Cladopora pulchra*, *Syringopora Hisingeri*, and *Cyathophyllum corniculum*, of the great Corniferous coral reef of the east, occur at the upper horizon, and *Syringopora perelegans*, of the same formation in New York, ranges throughout the group in Nevada. The occurrence of rare species and those of limited range in the eastern Devonian is not an unusual feature, as we find *Lingula Lœna*, *Strophodonta Patersoni*, *Chonetes hemispherica*, *Productus truncatus*, etc. The Trilobita also show the great range of the two species heretofore regarded as restricted to certain localities, viz, *Proetus Haldemani* and *P. marginalis*, and also the more widely distributed *Phacops rana*. Among species of a greater range there is the well-known *Pterinea flabella* in association with other forms of the Upper Helderberg formation at the Lower Devonian horizon; and *Sanguinolites rigidus* and *S. ventricosus*, of the Chemung Group, occur in the upper beds of limestone. The Gasteropoda are shown by *Platyostoma lineatum*, so abundant in the Hamilton formation of New York, and eight species of Platyceras, five of which are identical with eastern species, as are the four species of Tentaculites and the minute *Styliola fissurella* representing the Pteropoda.

The fortunate discovery of the interior of a dorsal valve of a rather large species of Lingula, *L. Whitei*, affords the means of comparison of the same parts of the shell with a Silurian and recent species of this genus, and proves the great structural similarity of the three species so widely separated in geologic time (Plate xxi, figs. 18, 19, 20).

The fauna of the White Pine shale in the White Pine District is in many respects a peculiar one, combining as it does species ranging from the Middle Devonian into the Lower Carboniferous. The stratigraphic position of the shale is at the summit of the Devonian system and at the base of the Carboniferous; it is overlain in the Eureka District, where the section is unbroken, by a massive belt of conglomerate before the limestones carrying the Lower Carboniferous fauna appear in the section. The strongly-marked Carboniferous species are, *Spiriferina cristata*, *Retzia radialis*, *Athyris sublamellosa*, and *Cardiomorpha Missouriensis;* these are associated, at the same horizon, with such Devonian species as *Discina Lodensis*, *Productus subaculeatus*, *Ambocœlia umbonata*, *Rhynchonella* (*L.*) *quadricostata*, *Aviculopecten catactus*, and *Lunulicardium fragosum*.

Messrs. Hall and Whitfield (Geol. Expl. Fortieth Par., vol. iv, p. 201) considered *Cardiomorpha Missouriensis* and fragments of a Spirifera of the type of *Spirifera Rockymontana* Marcou (=*S. Keokuk* Hall), as probably indicating a division of the black shales into Carboniferous and Devonian, but, from field observations and the assemblage of fossils, such a division is incompatible with the facts. The White Pine shales occupy the same position with relation to the Devonian and the Carboniferous systems as does the lower portion of the Pogonip limestone to the Cambrian and Silurian systems. In each case there are beds of passage carrying a fauna that unite the faunas of the two systems.

That the Devonian portion of the White Pine shale fauna is more nearly related to that of the shales of the Hamilton Group than that of the Chemung horizon, as found in the neighboring Eureka District, is owing undoubtedly to the character of the environment of the fauna during the deposition of the shales, a feature so well shown in the recurrent faunas of the Devonian of New York as studied by Prof. H. S. Williams.

A summary of the Devonian fauna is given in the following table:

Class.	Nevada.					Common to Nevada and—			
						New York.		Falls of Ohio.	Iowa.
	Genera.	Species.	Lower Devonian.	Upper Devonian.	Upper and Lower Devonian.	Genera.	Species.	Species.	Species.
Porifera	3	3	3	1	1	2	......	......	......
Actinozoa	14	27	15	13	1	11	11	9	3
Polyzoa	2	3	3	......	......	2	....	......	1
Brachiopoda	26	*83	50	51	18	26	38	8	11
Lamellibranchiata	29	42	27	17	2	27	9	2	2
Gasteropoda	13	39	23	17	1	11	12	4	......
Pteropoda	5	8	7	2	1	5	5	......	......
Cephalopoda	4	11	7	4	....	4	......	.....	......
Crustacea	2	2	2	......	......	2	......	......	......
Pœcilopoda	4	7	4	3	......	4	4	......	......
Total	102	225	141	108	24	94	79	23	17

* And five varieties.

Of the two hundred and twenty-five species, sixty-one are described for the first time, forty-five species are referred to genera but not specifically named, and one hundred and nineteen species are identified with species already known; of the latter, seventy-nine are identical with species found in New York State; eleven species occur in Iowa that are unknown in New York, and the remaining species occur in various localities both in the Rocky Mountains and the central and eastern portions of the continent. The stratigraphic position of each species is given in the systematic list at the close of the descriptions.

The Upper Helderberg horizon of the New York series is represented by thirty-eight species common to it and the lower portion of the Devonian of the Eureka District; the Chemung Group of the same by sixteen species; of the Hamilton species of New York, twenty-three are distributed through the lower portion of the Eureka Devonian limestone and eighteen species in the middle and upper portions, but not in such a manner as to distinguish a middle division corresponding to the Hamilton formation of New York. Of strictly Hamilton species in New York, twenty-three are found, of which eleven are in beds a little below the summit, and twelve just above the base of the formation.

Of ichthyic remains there is but one Ctenacanthus-like tooth. This with a single tooth of the genus Cladodus, brought from near the Hot Springs of Humboldt Cañon, by the geologists of the Fortieth Parallel Survey, is all that is known of this fauna in Central Nevada, although from the presence of a strongly-marked horizon of Devonian fishes in the Kanab Cañon of Northern Arizona, it is a little remarkable that so few specimens have been discovered to the north, where the formation has a much greater development.

With the exception of a species of Psilophyton, a fragment of Cordaites, and a few obscure fucoidal remains, the flora of the period is unrepresented, although in the upper beds the conditions necessary for the preservation of vegetable remains appear to have been favorable.

The Devonian corals as well as those of the Silurian and Carboniferous are not illustrated, and only short notes are given of a portion of the twenty-seven species occurring in the Devonian. From what is already known of this portion of the fauna, there is little doubt but that future collections from the area of the Great Basin will give a very complete series of species, and still further increase the number of species common to the eastern and central (or Atlantic and Mississippi) areas and the western or Rocky Mountain area.

The fauna of the Upper Carboniferous limestone is composed of old and well-known species usually occurring at that horizon, and gives but three species new to the region of the Rocky Mountains, viz, *Ptilodictya carbonaria*, *P. serrata*, and *Macrodon tenuistriata.* The comparatively few species occurring in the middle and upper portions of the Lower Carboniferous Group are also well-known forms, but at the lower horizon we meet with a most interesting assemblage of species. It embraces a large number of Lamellibranchiate shells, a class so rarely represented in collections from this region, and unites the characters of the fauna of the Lower Carboniferous groups of the Mississippi Valley with that of the Coal-Measures in a remarkable degree, a feature not uncommon in the Lower Carboniferous of the Rocky Mountains, but rarely so well shown as in the Eureka District.

There is also a certain commingling of Upper Devonian species with the Lower Carboniferous fauna. We find *Discina Newberryi*, *Macrodon Hamiltonæ*, *Grammysia Hannibalensis*, *G. arcuata*, *Sanguinolites Æolus*, and *Pleurotomaria nodomarginata* associated with common Carboniferous species.

The discovery of Pulmoniferous mollusks of the genera Physa and Zaptychius in association with the fresh-water shell *Ampullaria? Powelli* and fragments of a flora, coniferous in character, supports the stratigraphic evidence of the presence of a near or not distant land area at the time of the deposition of the Lower Carboniferous rocks of Central Nevada. It also gives the first notice of the occurrence of the Pulmonifera in rocks of this age; the land shells of Nova Scotia and Illinois occur in the Coal-Measures, and *Strophites grandæva*, Dawson, is from the Devonian plant beds of New Brunswick. The bearing of this discovery on the question of the presence of land areas from the time of the Middle Paleozoic to the present is important. No other explanation offers than that there was a continuous fresh-water habitat, ponds or streams, which permitted the genera to descend in a direct line from Paleozoic time to the present.

The grouping of the genera and species in the strata is shown in a general manner in the systematic list at the end of this volume, and in greater detail in the abstract of a report on the geology of the Eureka District, Nevada, by Mr. Arnold Hague, contained in the Third Annual Report of the Director of the United States Geological Survey.

In the accompanying table the number of genera and species known at present in the Paleozoic formations of Central Nevada is given:

Geologic horizons.	Genera.	Species.	Previously described species.	New species.	Unnamed species.	Recurrent species.
Cambrian	24	69	32	31	6	......
Silurian:						
Pogonip	47	99	34	31	34	15
Trenton, etc	14	15	4	......	11	......
Devonian	102	225	119	61	45	......
Carboniferous	65	132	53	50	29	3
Total	252	540	242	173	125	18
Recurrent	8	18	18	......	......	......
Total	244	522	224	173	125	......

FOSSILS OF THE CAMBRIAN.

PROSPECT MOUNTAIN GROUP.

PORIFERA.

Genus PROTOSPONGIA Salter.

Protospongia fenestrata Salter.

Plate ix, figs. 5, 5 *a*, *b*.

Protospongia fenestrata Salter, 1864. Quart. Jour. Geol. Soc., vol. xx, p. 238, pl. 13, fig. 12 *a*, *b*. *Ibid.*, Cat. Cambrian and Silurian Fossils, p. 3, 1873.
Hicks, 1874. Quart. Jour. Geol. Soc., vol. xxvii, p. 401, pl. 16, fig. 20.
Zittel, 1877. Abh. der K. bayer. Akademie der Wiss. 2 Cl., xiii; Bd. "Studien ii, fossile Spongien" (p. 45, sep. copy).
Carter, 1877. Ann. and Mag. Nat. Hist., ser. 4, vol. xxv, p. 177.
Brögger, 1878. On paradoxidesskifrene ved Krekling. Separataftryk af Nyt Magazin for Naturvidensk. vol. xxiv, i, p. 20, t. 6, f. 14.
Sollas, 1880. Quart. Jour. Geol. Soc., vol. xxxvi, p. 362, figs. 1, 2.
Roemer, 1880. Leth. Geogn., 1 Th. p. 316, f. 59.
Hinde, 1883. Cat. Fossil Sponges, p. 129, pl. xxviii, fig. 2.

Mr. Salter originally described this interesting sponge as having a loosely reticulate skeleton formed of very large cruciform spiculæ, the branches of which cross each other at an angle of 80°, and only in one plane, no ascending or descending branches rising from the point of conjunction. The angles occasionally vary, but not much.

More perfect specimens obtained by Dr. Hicks show the spiculæ to be quadriradiate, slightly raised at the center and formed of four nearly cylindrical rays.

The skeleton, as described by Mr. Sollas, is composed of large primary spiculæ with the interspaces filled in by three series of spiculæ, each formed of spiculæ smaller than those preceding it, their rays all lying regularly disposed in two directions at right angle to each other, and so building up a net-work with square meshes.

The skeleton is not preserved in any of the Nevada specimens, the different sized spiculæ lying scattered on the surface of the limestone shale or crowded together without any regularity to the direction of the rays or the size of the spiculæ. The spiculæ, however, appear to be identical in all respects with those described by Messrs. Salter, Hicks, and Sollas, and if they had not been scattered or crowded together by accident would form a skeleton similar to that described by Mr. Sollas. The under side of the spiculæ show no trace of a fifth ray or its point of attachment, appearing in this respect like the upper side, except that the surface is a little concave instead of convex as on the upper side. They are silicious, and differ in mineral character from the spiculæ from the Cambrian rocks of Wales which have been replaced by pyrite.

Dr. Hicks states that *P. fenestrata* occurs in the Longmynd Group, in the Menevian Group, and also in the Upper Lingula flags to the base of the Tremadoc rocks, giving a vertical range of from 8,000 to 10,000 feet (Quart. Jour. Geol. Soc. London, vol. xviii, p. 181. 1872). It also occurs in black shales of Cambrian age in Norway and Sweden.

Formation and localities.—Cambrian, Prospect Mountain Group. In the mountain shale near the Eldorado mine, and in the Secret Cañon shale on the east side of Secret Cañon, Eureka District, Nevada.

BRACHIOPODA.

Genus LINGULEPIS Hall.

Lingulepis Mæra H. & W.

Lingulepis Mæra Hall & Whitfield, 1877. Geol. Expl. Fortieth Parallel, vol. iv, p. 206, pl. i, figs. 5–7.

The specimens referred to this species are specifically identical with the types collected by the geologists of the Fortieth Parallel Survey in the Eureka District.

The species is well represented, and appears to be characteristic of the upper portion of the Cambrian and the lower horizon of the Silurian, Pogonip Group. It occurs in the Secret Cañon shale of the Cambrian on the eastern side of the cañon directly east of Ruby Hill; in the limestone of the Pogonip Group northeast of Adams Hill; on the ridge southeast of the Jackson mine; on the southwest spur of Wood Cone, and southeast of the Hamburg mine, Eureka District, Nevada.

Lingulepis ? minuta H. & W.

Lingulepis ? minuta Hall & Whitfield, 1877. Geol. Expl., Fortieth Parallel, vol. iv, p. 206, pl. i, figs. 3, 4.

This species has nearly the same vertical range and geographical distribution as *Lingulepis Mœra*, usually occurring in the same localities. The type specimens were obtained in the Eureka District by the members of the Fortieth Parallel Geological Survey.

Genus LINGULA Bruguière.

Lingula ? manticula White.

Plates ix, fig 3, and xi, fig. 2.

Lingula ? manticula White, 1874. Expl. and Surv. West 100th Merid.; Prelim. Rep. Pal., p. 9. *Ibid.*, vol. iv, pt. 1, p. 52, pl. iii, figs. 2 *a*, *b*, 1875.

The range of variation among the specimens we have referred to this species is greater than exists between them and our conception of *L. ? manticula*, as obtained from the description and illustrations given by Dr. White, and without a direct comparison with the type specimens to determine any specific differences, if they exist, we consider them as one species. As none of the examples show the internal characters of the shell, the doubtful character of the generic reference remains unchanged.

The type specimens were collected in the Schell Creek Range of Nevada, at an horizon in the Silurian, equivalent probably, to the horizon at which the species occurs in the Pogonip Group.

Formation and localities.—Cambrian, Prospect Mountain limestone, just beneath the Secret Cañon shale, in the 700-foot level of the Richmond mine, Ruby Hill; at the summit of the Secret Cañon shale in New York Cañon; also in the lowest portion of the Pogonip limestone northeast of Adams Hill and higher up in the same group on the eastern slope of the ridge east of the Hamburg Ridge, Eureka District, Nevada.

Genus OBOLELLA Billings.

Obolella discoidea H. & W.

Obolella discoidea, Hall & Whitfield, 1877. Geol. Expl. Fortieth Parallel, vol. iv, p. 203, pl. i, figs. 1, 2.

This is one of the species brought in by the geologists of the Fortieth Parallel Survey from the Eureka District. It occurs in the Hamburg shale of the Cambrian, and the Pogonip Group of the Silurian, on the ridge east of the Hamburg Ridge and at the Pogonip horizon in the limestone northeast of Adams Hill; also on the first ridge southeast of the Jackson mine, Eureka District, Nevada; and in the Pogonip limestone on Pogonip Ridge, White Pine District, Nevada.

Genus ACROTHELE Linnarsson.

Acrothele? dichotoma, n. sp.

Plate ix, fig. 11.

Shell of medium size, thin, corneous, nearly circular in outline, the transverse diameter being a little greater than the longitudinal.

Ventral valve depressed, discoid, with the apex but slightly elevated above the general plane of the surface and situated about one-third the distance from the posterior to the anterior margin. The apex is perforate and has a narrow groove around it, except on the posterior side, where a low rim alone separates the groove and the slightly-depressed pseudo-deltidial area. This area is triangular in form, and extends to the posterior margin, gradually expanding to a width a little less than its length; it appears to have been quite minute at first just beneath the apex and to have been filled in by successive additions of the shell, so that the general circular outline of the shell has scarcely been broken by the very slight truncation of the posterior margin. The additions to the posterior margin of the false area are crowded together as little transverse ridges with fine striæ between.

The outer portion of the shell is largely exfoliated, but traces of radiating striæ and concentric lines of growth are shown. The latter on the outer portion appear to have been continuous with those crossing the pseudo-deltidial area. From each side of the apex a narrow, elongate, muscular scar gently diverges, extending towards the central portion of the shell. Transverse diameter, 7.5^{mm}; longitudinal diameter, 6.75^{mm}; elevation or convexity, about 0.75^{mm}.

The reference of this species to the genus *Acrothele* is made with reservation. Its depressed form and eccentrically-perforated apex are similar, while the false area and the muscular scar are different. It is, however, more closely allied to *Acrothele* than with any genus with which we are acquainted.

Formation and locality.—Cambrian, Prospect Mountain Group; upper beds of the Secret Cañon shale, on the east side of Secret Cañon, Eureka District, Nevada.

Genus SCENELLA Billings.

Scenella ? conula, n. sp.

Plate ix, fig. 6.

Shell small, conical; apex subcentral, apparently with a tendency to bend a little to one of the sides on which there is a very faintly-indicated line running from the apex to the margin. Aperture ovate. Surface smooth to the unaided eye; it shows fine concentric striæ and a few obscure lines of growth when examined by the aid of a strong magnifying glass.

Dimensions.—Greater diameter, 3^{mm}; lesser diameter, 2.25^{mm}; elevation, about 1.75^{mm}.

This is a small Metoptoma-like shell, the generic reference of which is provisional, as it differs from the type of the genus, *Scenella reticulata*, in not having a carina running from the apex to the margin; the curvature of the apex is not positively known, as its summit is broken off in all the specimens in the collection.

The line from the apex to the margin is too strongly represented in the figure on plate ix.

Formation and locality.—Cambrian, Prospect Mountain Group; low down in the massive limestone beneath the Secret Cañon shale on the east slope of Prospect Mountain, Eureka District, Nevada.

Genus ACROTRETA Kutorga.

Mr. Davidson, in his Classification of the British Fossil Brachiopoda, gives an accurate generic description of the external form and character of the valves of Acrotreta, but not having specimens showing the interior of the valves, he left the genus doubtfully as a subgenus of Siphonotreta. The fortunate discovery of a large number of specimens of *Acrotreta gemma* Billings, in the passage-beds between the Cambrian and Silurian limestones of the Eureka District, affords material for the study of the interior characters of the smaller valve, and also some of those of the larger or conical valve.

The interior of the larger valve shows a perforated, rounded, nipple-like projection extending down from the apex, plate 1, fig. 1*f.* This is well shown in the cast, fig. 1*b.* On each side a slight ridge extends obliquely forward. No other markings can be determined. In the smaller valve a strong median ridge extends from in front of a minute triangular space on the cardinal margin two-thirds the distance to the front margin of the shell. Just back of the center of the shell a small oval scar occurs on each side of the ridge, and near the cardinal margin another pair of larger crescentiform scars. A pair of lateral marginal scars are very faintly shown on two examples. They are usually too indistinct to be recognized.

Comparing this interior with that of the smaller valve of *Siphonotreta unguiculata*, as illustrated by Davidson (Geol. Mag. N. S., vol. iv, pl. ii, fig. 11, 1877), the differences between them are well marked, especially in the greater spreading out of the muscular impressions in Acrotreta.

In the larger valves the conical form and siphonal tube strongly relate them. (See plate i, figs. 1*b*, 1*f*, and fig. 8.)

The interior of the smaller valve shows a wonderful similarity to that of *Obolella ? Scabrinæ* Callaway (Dav. Mon. Brit. Foss. Brach., vol. v, pt. ii, p. 211, pl. xvi, fig. 27*d*), (see plate 1, fig. 1*c*,) and I can hardly understand that they belong to separate genera. If the conical valve of *O. ? Scabrinæ* should be found to show indications of a perforate apex, the relations of the species to *Acrotreta gemma* would be very close.

Acrotreta gemma Billings.

Plate i, figs. 1*a*, 1*f*, 1*d–f*; plate ix, figs. 9, 9*a*.

Acrotreta gemma Billings, 1865. Palaeozoic Fossils, vol. i, p. 216, figs. 201*a*, *f*.
Acrotreta subconica and *A. attenuata* Meek, 1873. Sixth Ann. Rep. U. S. Geol. Surv. Terr., p. 463.
Acrotreta pyxidicula White, 1874. Expl. and Surv. West 100th Merid., Rep. Invert, Foss., p. 9. *Ibid.*, vol. iv, p. 53, pl. iii, figs. 3 *a–d*, 1875.

The specific identity of the forms from Nevada with those from Newfoundland scarcely permits of question if based on the description and illustrations given by Mr. Billings. Some specimens have the conical valve more or less elevated, but the difference is not of specific value.

Dimensions of an average specimen: height of conical valve, 1.75^{mm}; transverse diameter, 2^{mm}; longitudinal diameter, 1.75^{mm}.

The species from the passage beds between the Cambrian and Silurian faunas on the Gallatin River, Montana, doubtfully identified by Mr. Meek as *A. subconica* Kutorga, and in case of eventually proving to be a distinct species to be called *A. attenuata*, proves on comparison to be the same as the Eureka species, and it is also associated with *Iphidea sculptilis*, *Agnostus bidens*, and *Ptychoparia Oweni*, at each locality. The mesial furrow on the false area is a variable character, as also within somewhat broad limits the depression or elevation of the conical valve. With the specimens before me for comparison, they are all referred to the one species and identified with *A. gemma*. *Acrotreta pyxidicula* White, from Nevada, occurs at about the same geologic horizon. The smaller valve is identical with that of *A. gemma;*

the larger is greatly depressed, but there are examples uniting it with the more elevated valve of *A. gemma.*

Formation and localities.—Cambrian and Silurian. At the summit of the Secret Cañon shale in New York, and Secret Cañons, and opposite the dump of the Richmond mine shaft, Ruby Hill; it also passes up through the shaly beds capping the massive Hamburg limestone belt into the beds of the Pogonip Group, on the ridge opposite the Hamburg mine; at about the same horizon northeast of Adams Hill, and on the ridge southeast of the Jackson mine, Eureka District, Nevada. The species was found in 1882 on Pogonip Ridge, White Pine District, Nevada.

Genus KUTORGINA Billings.

Kutorgina Whitfieldi, n. sp.

Plate ix, figs. 4, 4*a*.

Shell convex, hinge line straight and a little less than the greatest width of the shell, sides rounding regularly into the slightly convex frontal margin.

Ventral valve quite convex, elevated along the center to form a flat depressed fold, and sloping quite rapidly from this to the lateral and cardinal margins; median elevation with about five rather faintly-defined, simple plications that reach up to the higher portion of the valve; beak small, a little depressed, and rising above the area; cardinal margins straight and diverging from the beak at an obtuse angle; character of area unknown.

Dorsal valve depressed convex, with a rather wide, shallow, median depression, and two short plications on each side of it towards the front, which are obsolete in some of the specimens; the area between the cardinal edges and the elevation of the sides of the mesial depression is depressed and corresponds to the flattened lateral slope of the ventral valve.

Surface marked by fine, very clearly defined concentric striæ subparallel to the front and lateral margins. The striæ are crowded together into narrow ridges, giving the appearance mentioned by Mr. Billings as occurring on the type species of the genus.

This species is unlike any described that is known to me. In general form and surface characters it is allied to *Kutorgina cingulata* Billings, and is undoubtedly of the same genus if the shells illustrated by figs. 8 and 10, on page 8, of the "Paleozoic Fossils of Canada," vol. i, are taken as types. The specific name is given in honor of Prof. R. P. Whitfield, the distinguished paleontologist.

Formation and locality.—Cambrian. Prospect Mountain Group, beneath the Secret Cañon shale, on the west side of Secret Cañon, Eureka District, Nevada.

Kutorgina Prospectensis, n. sp.

Plate ix, figs. 1*a*, *b*.

Shell rather small for a species of the genus. It is thick and black, like a linguloid shell.

Ventral valve elevated, with the apex projecting over the triangular area and extending considerably beyond the posterior margin; owing to the exfoliation of the shell the extremity of the apex is unknown; the surface of the area is also unknown. Ventral valve depressed, slightly convex, without a mesial sinus; marginal outline subcircular, with the posterior margin obtusely angular at the beak; the beak is slightly depressed below the highest point of the shell, and apparently projects a trifle beyond the cardinal edge. Surface marked by strongly-defined fine concentric striæ, ten in a distance of one millimeter, where they terminate on the posterior margin.

The dorsal valve of this species is much like that of *Iphidea Labradoricus* Billings, but it does not appear to come within the limits of that genus as defined by the type species.

Formation and locality.—Cambrian. In an arenaceous shale resting on the Prospect Mountain quartzite, summit of Prospect Mountain, Eureka District, Nevada.

Kutorgina sculptilis Meek (Sp).

Plate i, figs. 7, 7 *a*, *b*; pl. ix, fig. 7.

Iphidea (? ?) *sculptilis* Meek, 1873. Sixth Ann. Rep. U. S. Geol. Surv. Terr. for the year 1872, p. 479.
Kutórgina minutissima Hall & Whitfield, 1877. U. S. Geol. Expl. Fortieth Par., vol. iv, p. 207, pl. i, figs. 11, 12.

Shell minute, semicircular to subquadrangular; hinge line usually a little shorter than the greatest width of the shell; sides slightly rounded; antero-lateral angles rounded; frontal margin gently convex or nearly straight along the middle.

Ventral valve obliquely depressed, subconical, with the somewhat obtusely pointed apex on, or slightly extending over, the cardinal line; area vertical or bending a little backward, triangular; width a little more than twice the height, but not as broad as the shell, owing to the sides of the latter curving in to meet the straight area at an angle of about 50°; foramen (?) large, dorsal valve depressed convex, most elevated on the umbo; beak a little depressed, scarcely projecting beyond the cardinal line; mesial sinus faintly defined, not much more than a slight flattening in many examples; area low, general characters unknown.

Surface of the shell marked by very fine, sharp, elevated, concentric lines, that coalesce or bifurcate irregularly, giving a peculiar, interrupted, wavy appearance under the magnifier; these lines extend around on the sides of the posterior side or area to the edges of the triangular foraminal-like opening. Slightly irregular, slender, depressed or elevated interrupted lines radiate from the beak or apex; they vary in strength and number, and on some shells are scarcely discernible, although forming a prominent feature in many individuals.

Length of largest shell observed, 2.5^{mm}; breadth, 3.75^{mm}; depth of ventral valve, 1.25^{mm}; of dorsal valve, 0.5^{mm}.

The type of *Iphidea* (??) *sculptilis* (Meek) is a strongly marked ventral valve of this species from the east side of the Gallatin River, Montana, where it is associated with *Acrotreta gemma* Billings, and *Ptychoparia Oweni* Meek.

In the Eureka District it is associated with the same species at the same relative geological horizon. I now have before me Mr. Meek's type, and also the type of *Kutorgina minutissima* H. & W., from the Eureka District. They evidently belong to one species and do not vary from each other more than individuals from the same locality.

The generic reference of the species by Messrs. Hall and Whitfield is followed, as from all comparable characters the species is closely allied to the type of the genus *Kutorgina cingulata* Billings.

As yet no evidence has been obtained of the presence of a pseudo-deltidium similar to that in *Iphidea bella* Billings. Mr. Meek failed to detect it in working away the matrix from the specimens he used, and the same is the case with the material from the Eureka District. From the fact that the pseudo-deltidium is often absent in specimens of a well-marked species allied to *I. bella* now before me, and the great similarity of the false area of the larger valves of it and *K. sculptilis*, when in that condition, I strongly suspect that if we had more perfect specimens the concentric surface lines would not stop at the margin of the triangular space, but cross a pseudo-deltidium, as in *I. bella.*

As stated by Mr. Billings, the genera Kutorgina and Iphidea are closely related to each other, and while it is convenient to have the two genera to refer such forms as *K. sculptilis* and *I. bella,* with our present knowledge of the two genera, Iphidea cannot be considered as a well-established genus, although it is quite probable that if we had the interior of the shell of each form it would be necessary to distinguish them as Mr. Billings has done.

Formation and localities.—Upper Cambrian. Secret Cañon shale on the east side of Secret Cañon; shaly limestone in passage-beds between the Cambrian and Silurian on the first ridge east of the Hamburg Mine, Eureka District, Nevada. Also, on the east side of the Gallatin River above Gallatin City, Montana, as labelled in the collections of the United States National Museum.

Genus LEPTÆNA Dalman.

Leptæna Melita H. & W.

Leptæna Melita Hall & Whitfield, 1877. Geol. Expl. Fortieth Par., vol. iv, p. 208, pl. i, figs. 13, 14.

This species is given by its authors as occurring in the Lower Silurian rocks of the Eureka District, the exact horizon being unknown. From the examples in the present collection we learn that it ranges from the limestone beneath the Secret Cañon shale on the eastern slope of Prospect Mountain, up through the intervening strata to about 500 feet above the base of the Pogonip Group, at which horizon it is found on the ridge next east of the Hamburg Ridge; also southeast of the Jackson mine, and northeast of Adams Hill, Eureka District, Nevada.

Genus ORTHIS Dalman.

Orthis Eurekensis, n. sp.

Plate ix, figs. 8, 8*a*.

Shell small, transversely suboval, strongly convex. The ventral valve is more convex than the dorsal, and elevated along the middle so as to become subcarinate; beak small; area unknown.

Dorsal valve convex, with a strongly marked median depression that gives it a bilobed character; beak short and apparently incurved over a low area.

Surface marked by about forty strong, simple, radiating striæ that extend up to the beak.

Dimensions.—Transverse diameter, 4^{mm}; length of ventral valve, 3.5^{mm}; of dorsal valve, 3^{mm}; depth of ventral valve, 1.5^{mm}; of dorsal valve, about 1^{mm}.

From the nature of the matrix the beaks of the valves are usually broken away with a portion of the shell on the summit, so that the cast of the hinge-teeth of the ventral valve and the muscular impressions of the dorsal valve are shown, as seen in fig. 8*a*, plate ix.

We know of no similar form from this horizon with which to compare this shell, its small size, bilobed dorsal valve, and subcarinate ventral valve distinguishing it from all other described species.

Formation and locality.—Cambrian. Prospect Mountain Group, at the base of the Secret Cañon shale, on the west side of Secret Cañon, Eureka District, Nevada.

PTEROPODA.

Genus STENOTHECA Salter.

Stenotheca elongata, n. sp.

Plate ix, figs. 2, 2*a*.

Shell small, elongate, with the apex incurved and depressed nearly to the margin; laterally compressed so as to form a ridge nearly the entire length. Aperture elongate, ovate, somewhat acutely pointed at the end towards which the apex curves and rounded at the opposite extremity, the greatest width occurring about two-thirds the distance from the narrow end. Surface marked by numerous fine concentric striæ and lines of growth.

The narrow elongate aperture, depressed apex, and fine lines of growth serve to distinguish this from described species of the genus. As far as yet known the genus Stenotheca is confined to the Cambrian fauna.

Formation and locality.—Cambrian. Prospect Mountain Group, in the limestone just beneath the Secret Cañon shale, on the west side of Secret Cañon, Eureka District, Nevada.

Genus HYOLITHES Eichwald.

Hyolithes primordialis Hall (Sp.)

Theca primordialis Hall, 1861. Rep. Prog. Geol. Surv. Wisconsin (pam.), p. 48. *Ibid.*, Geol. Wis., vol. i, p. 21, fig. 5, 1862. *Ibid.*, Sixteenth Rep. N. Y. State Cab. Nat. Hist., p. 135, pl. vi, figs. 30, 31, 1863.

Hyolithes (Theca) *primordialis* Hall and Whitfield, 1873. Twenty-third Rep. N. Y. State Cab. Nat. Hist., p. 242, pl. ii, fig. 3.

Hyolithes primordialis? White, 1874. Expl. and Surv. West 100th Merid., Prelim. Rep. Invert. Foss., p. 6. *Ibid.*, vol. iv, pt. 1, p. 37, pl. 1, figs. 5*a–e*, 1875.

Hyolithes primordialis Whitfield, 1883. Geol. Wisconsin, vol. iv, p. 175, pl. 1, fig. 12.

There appears to be very little difference between the Eureka specimens and those described by Professor Hall from the Potsdam sandstone of Wisconsin. Dr. C. A. White describes similar forms from Pioche, Nevada, where they occur in strata of ("Primordial") Cambrian age.

Formation and localities.—Cambrian. Prospect Mountain Group, in the upper beds of the Secret Cañon shale, on the east side of New York and Secret Cañons, and on the east side of the cañon at the eastern side of Ruby Hill. Also in an outcrop of limestone on the west side of the foothills of Combs' Peak, Antelope Valley, Eureka District, Nevada.

PŒCILOPODA.

Genus AGNOSTUS Brongniart.

Agnostus Richmondensis, n. sp.

Plate ix, fig. 10.

Cephalic shield moderately convex, length and breadth equal, sides scarcely parallel, rounding in front into the broadly rounded anterior margin. Glabella three-fourths the length and a little more than one-third as wide at the base as the width of the shield, it is elongate-conical in outline, strongly defined by the dorsal furrows, and with the anterior third separated by a distinct transverse furrow, a little less than midway between this furrow and the posterior margin a short furrow penetrates from each side towards the base of a minute tubercle situated on the median line, two oblique furrows cut off the posterior lateral angles as two small rounded, triangular nodes; lateral lobes more convex than the glabella, divided anteriorly by a slight median furrow, surrounded by a narrow, rim-like margin, and ornamented by slightly irregular depressed lines that indent the surface from the margin nearly to the edge of the strong dorsal furrows.

Surface smooth under an ordinary magnifying power.

Dimensions.—Length and breadth, 2.5^{mm}; depth of shield, 0.75^{mm}. Thoracic segments and caudal shield unknown.

This is a very striking and pretty species, and is not liable to be mistaken for any described American form, and it appears to be distinct from any European species known to me, although allied in a slight degree to *Agnostus princeps* Salter.

Formation and localities.—Cambrian. Prospect Mountain limestone, upper portion; Ruby Hill, Richmond mine, 700-foot level; and east slope of the northern portion of Prospect Mountain, Eureka District, Nevada.

Agnostus seclusus, n. sp.

Plate ix, fig. 14.

Cephalic shield strongly convex, a little longer than wide, with a slight contraction posteriorly and margined by a narrow, rim-like border that has a distinct groove between it and the lateral lobes; dorsal furrows well defined, united anteriorly, but not dividing the lateral lobes in front, posteriorly each turns obliquely outward, a short distance from the margin, cutting off the inner angle of the lateral lobes. Glabella short about one-half the length of the shield, strongly convex and squarely truncated in front; at about the anterior third a broad, short furrow penetrates on each side a short distance, and posteriorly a rounded node is separated from each lateral angle by slight furrows; the lateral lobes slope rapidly to the marginal groove on the sides and more gradually to the front.

Surface finely granulose.

Dimensions.—Length, 3^{mm}; breadth, nearly the same; depth of shield, 1.25^{mm}.

Thoracic segments and caudal shield unknown.

This species is characterized by the tumid, short, truncated glabella and broad lateral lobes.

Formation and locality.—Cambrian. Prospect Mountain Group; upper portion Secret Cañon shale, on the east side of Secret Cañon, Eureka District, Nevada.

Agnostus bidens Meek.

Plate ix, figs. 13, 13 *a*.

Agnostus bidens Meek, 1873. Sixth Ann. Rep. U. S. Geol. Surv. Territories for the year 1872, p. 463.

Cephalic shield, moderately convex; a little wider than long, distinctly trilobed and bordered by a rounded margin, with a rather strongly defined marginal groove. Glabella convex, narrow, more than two-thirds the length of the shield, converging anteriorly and rounded or subangular in front; a narrow, transverse furrow enters obliquely from each side posterior to the center and unites just in advance of a small tubercle on the center of a segment defined behind by a transverse furrow that bends backward at the center; between the latter furrow and the occipital furrow, a narrow segment widening out laterally, is distinctly defined; occipital segment very narrow. Dorsal furrows distinct, united in front of the glabella but not touching the frontal border. Lateral lobes strongly convex and sloping rapidly to the marginal groove from the somewhat elevated central portion; frontal lobe about half as wide as the lateral lobes and less convex.

Thoracic segments unknown.

The caudal shield associated with the above-described head has all of its essential elements, and there is little doubt but that it belongs to the same species. It is provided with a short spine or process on each posterior lateral side and is strongly convex and trilobate; the axial lobe extends more than three-fourths of the entire length and has an elongate, angular node on the anterior portion, with a transverse furrow just before it separating a narrow anterior portion, and in some examples a slight transverse furrow crosses just back of the node; this is obsolete in many instances. The dorsal furrows extend backward and unite posteriorly, giving the axial lobe a conical form; lateral lobes strongly convex and very much like those of the associated cephalic shield. Surface of both shields finely granulose under a strong magnifying power.

Dimensions of cephalic shield.—Length, 3.25^{mm}; width, 3.75^{mm}; caudal shield as 4 is to 5 in length and breadth respectively.

A comparison of specimens made after the manuscript of this report was written shows that the supposed new species of Agnostus is identical with Mr. Meek's *A. bidens* from the Gallatin River, Montana, also that *Ptychoparia Gallatinensis* occurs in association with it in Montana and Nevada.

Formation and localities.—Cambrian. Prospect Mountain Group; ranges from the upper portion of the massive Prospect Mountain limestone as found in the 700-foot level of the Richmond mine at Ruby Hill and on the east slope of Prospect Mountain, to the summit of the Hamburg limestone, near the Hamburg mine, and into the base of the Pogonip Group, occurring most abundantly in the upper beds of the Secret Cañon shale, Eureka District, Nevada. Also in the Lower Pogonip Group on Pogonip Ridge, White Pine District, Nevada.

Agnostus communis H. & W.

Agnostus communis Hall & Whitfield, 1877. Geol. Expl. Fortieth Parallel, vol. iv, p. 228, pl. i, figs. 28 and 29.

This species has a vertical range similar to the preceding, and occurs at the same localities, although rarely in the same layer of rock. The original specimens were collected by the geologists of the Fortieth Parallel Survey from the White Pine Mining District, Nevada.

Agnostus Neon H. & W.

Agnostus Neon Hall & Whitfield, 1877. Geol. Expl. Fortieth Parallel, vol. iv, p. 229, pl. i, figs. 26, 27.

Associated with *Agnostus communis*, and having essentially the same range and distribution in the district, the original types coming from the Eureka District, Nevada, by the same survey.

Agnostus prolongus H. & W.

Agnostus prolongus Hall & Whitfield, 1877. Geol. Expl. Fortieth Parallel, vol. iv, p. 230, pl. i, figs. 30, 31.

This form was originally collected in the Eureka District, but it is rare, having been found only in the Hamburg belt of limestone northeast of Adams Hill, and on the west side of Sierra Cañon, Eureka District, Nevada.

Genus OLENELLUS Hall.

Olenellus Iddingsi, n. sp.

Plate ix, fig. 12.

General outline of the head roughly subtriangular, with the length one-half the breadth of the posterior border; strongly convex; the rather narrow, rounded rim bordering the anterior margin suddenly becomes thickened and rounded opposite the eyes and is extended back in the short, strong, slightly curved genal spines, the narrow posterior marginal border uniting with it at the genal angles. Glabella elongate, narrow, divided by four transverse furrows into five lobes; the anterior is round, tumid, and expanded laterally, while the four posterior are narrow, transverse, of equal size, and with their sides parallel; occipital ring and furrow not recognized; eyes lunate, situated opposite the central lobes of the glabella. Facial suture in front of the eye unknown; back of the eye it extends obliquely outward and backward, cutting the posterior margin about two-thirds the distance from the glabella to the postero-lateral spine.

Thorax and pygidium unknown.

The specific name is given in honor of Mr. J. P. Iddings, the discoverer of the type specimen.

Formation and locality.—Cambrian. Prospect Mountain Group, in an arenaceous shale above the quartzite capping Prospect Peak, Eureka District, Nevada.

Olenellus Gilberti Meek.

Plate ix, fig. 16, 16 *a*; pl. xxi, fig. 13.

Olenellus Gilberti Meek, 1874. (Manuscript.)
Olenellus Gilberti White, 1874. Geog. and Geol. Expl. and Surv. West 100th Merid.; Prelim. Rep. Invert. Foss., 7.
Olenus (*Olenellus*) *Gilberti* Meek, 1875. Geog. and Geol. Surv. West 100th Merid., vol. iii, Geology, p. 182.
Olenellus Gilberti White, 1875. Geog. and Geol. Expl. and Surv. West 100th Merid., vol. iv, pt. i, p. 44, pl. ii, figs. 3 *a*, *e*.

Head semioval in outline, moderately convex, margined all around by a narrow wire-like rim, which is produced at the genal angles into slender spines. Glabella elongate, narrowing slightly towards the front; general surface moderately convex anteriorly, becoming less so back of the frontal lobe; the glabellar furrows penetrate obliquely backward nearly to the median line, with the exception of the second anterior pair, which are shown by elongate depressions on the line of division of the second and third anterior lobes, the two lobes uniting laterally so that the furrows do not extend to the dorsal furrows; the frontal glabellar lobe is convex, oval in outline, with a tendency in some examples to become angular in front; the two posterior lobes are subequal in size; the occipital ring and furrow well defined; eyes elongate, narrow, arching outward from the point where the anterior glabellar furrow meets the dorsal furrow, and backward to the posterior glabellar furrow; dorsal furrows shallow; the fixed and free cheeks united form a broad slope from the eye to the lateral margins and anteriorly merge into the long frontal limb. The facial sutures cannot be traced in any of the specimens. Thorax and pygidium unknown.

The above description is drawn from specimens obtained in the Eureka District. The differences between them and the type specimens are almost entirely in the frontal limb, the former having a much broader space between the front of the glabella and marginal rim. In some examples from the typical locality of the species at Pioche, Nevada, the frontal limb is much broader than in those illustrated in Dr. White's report, the Eureka form appearing to be specifically identical with them.

Formation and locality.—Cambrian. Prospect Mountain Group, in an arenaceous shale above the quartzite capping Prospect Peak, Eureka District, Nevada.

Olenellus Howelli Meek.

Plate ix, figs. 15, 15 *a*, *b*, and pl. xxi, figs. 1, 9.

Olenellus Howelli Meek, 1874. (Manuscript.)
Olenellus Howelli White, 1874. Geog. and Geol. Expl. and Surv. West 100th Merid.; Prelim. Rep. Invert. Foss., p. 8.
Olenus (*Olenellus*) *Howelli* Meek, 1875. Geog. and Geol. Surv. West 100th Merid., vol. iii, Geology, p. 183.
Olenellus Howelli White, 1875. Geog. and Geol. Expl. and Surv. West 100th Merid., vol. iv, pt. 1, p. 47, pl. ii, figs. 4 *a*, *b*.

The general outline of the head of the adult is semi-elliptical or semicircular and more or less strongly convex. The margin is bordered by a narrow, rounded rim which becomes thickened near the genal angles and continues posteriorly as rather short, sharp spines. The glabella is elongate and more or less expanded in front and behind, contracting a little midway; four pairs of glabellar furrows penetrate from each side; they are somewhat strongly impressed on each lateral third of the width of the glabella, becoming more shallow as they pass into the more shallow furrow that unites them across the center; in younger specimens this furrow is undistinguishable from the lateral furrows and they all unite as one distinct furrow crossing the glabella from side to side, and even in the adults this feature is strongly marked in some individuals; the anterior lobe of the glabella is more or less tumid, subhemispherical or a little transverse and wider than the greatest width of the glabella immediately behind it; the next posterior lobe is rather narrow and transverse, differing from the two next posterior lobes, which are wider and curved a little forward at the ends, by the direction of the furrows; the posterior lobe corresponding to the occipital ring or segment is broad and essentially of the same character as that preceding it; the furrow separating them is very shallow at the center and inclined obliquely backward at the sides; a small node occurs on one example at the center of the occipital ring.

Eyes elongate, narrow, and arching from opposite the anterior glabellar lobe to opposite the occipital furrow. The dorsal furrows are narrow, distinctly but not deeply impressed. Fixed cheeks a little expanded anteriorly and scarcely more than a line between the elongate palpebral lobes and the dorsal furrows, while posteriorly they merge into the small triangular lateral limbs; frontal limb obsolete. Free cheeks large, roughly subtriangular in outline, their posterior margin marked by a more or less prominent curve or angle between the genal angle and the inner end of the margin.

The facial suture cuts the anterior margin some distance outside the line of the outer margin of the glabella and passes obliquely inward to the anterior angle of the eyelobe; curving around the outer margin of this, it passes obliquely outward to the posterior margin, cutting it about midway between the glabellar lobe and the outer margin of the genal angle.

The surface of the glabella is beautifully ornamented with transverse, fine, irregularly-waving, subimbricating lines that give the appearance of imbricating lamellæ resting one under the other from before backward; this feature is only seen on the most perfectly preserved specimens; the surface of the cheeks is slightly granulose under a strong magnifying glass. The test itself is very thin and fragile and is usually broken away.

Thorax and pygidium unknown. Portions of the pleural lobe of several thoracic segments were found in association with the heads of this and the preceding species that show that the pleuron is prolonged in all of them, in one more than the others, and that the portions of the segments preserved are typical in their character of the genus; the pleural groove is strong and broad, continuing well out towards the extremity beyond the geniculation.

The description of the cephalic shield is that of what is considered as the normal, adult type of the head, and omits altogether the phases of this remarkable species that are shown in its various stages of growth and development. A note and several figures in illustration are appended that were prepared after the first study of the collections.

The above description was written in 1880 under the impression that the species was undescribed. On obtaining a large number of specimens in 1882, it was found that the species could be connected with *Olenellus Howelli*, a species founded by Mr. Meek on a single large head from the Cambrian at Pioche, Nevada. On a direct comparison with the type the larger specimens are seen to be essentially the same if we allow for the compression of the Eureka specimens in the sandy shale.

Formation and locality.—Cambrian. Prospect Mountain Group in an arenaceous shale above the quartzite capping the summit of Prospect Peak, Eureka District, Nevada.

OBSERVATIONS ON OLENELLUS HOWELLI.

Platé xxi, figs. 1–17.

The study of the material in the collection illustrating this species having developed some interesting facts, they are here discussed under two heads: First, the character of the species during the later stages of its development as far as known; second, the relation of the species to other species of the same genus, and to certain species of the genus Paradoxides.

I. A series of specimens illustrating the principal embryonic and abnormal features of development are figured on plate xxi, figs. 1–9, the details of which, and also the figures up to fig. 18, are given in the explanation accompanying the plate.

Contour of the head.—The smallest specimen of the head observed, fig. 1, is 2.5^{mm} in length, and resembles in its outline the larger head, fig. 3, which has a length of 7.5^{mm}, as is seen more clearly by comparing the latter with the enlarged figure of fig. 1, on plate ix, fig. 15*b*. Between figs. 1 and 3, in size, is the form represented by fig. 2, which is transversely quadrilateral in outline, with the genal angles and spines carried forward to form antero-lateral angles on a line with the frontal margin of the head and the geniculation of the posterior margin, which is so strongly marked in fig. 1, is still further increased to form an angle of nearly 90°, which, from its position, might be incorrectly viewed as the true genal angle if the anterior spines were broken away or obscured and the course of development of the species unknown. In fig. 4 the genal spines are still more anterior than in the smaller forms (figs. 1 and 3), presenting a transition stage, not considering the size of the head, but the general form, between figs. 1 and 2 or 2 and 3, the angles of the posterior margin $x\,x$, are also more obtuse and the frontal margin broadly rounded. Through the forms represented by figs. 3 to 5 the modification of these features is very uniform to the normal adult type of the contour of the head, as shown by fig. 6. In figs. 7 and 8, however, which are considerably larger specimens, the angularity of the posterior margin is a prominent feature, the genal angles being advanced as in the forms before fig. 6. In fig. 9 the outline is still further diversified by having the angularity of the posterior margin and the position of the genal spine on one side differing from that on the other. Fig. 6 is considered as nearly typical of the adult outline of the head as the largest specimen found, and a number of medium size have the same form. The geniculation of the posterior margin is an embryonic character that is singularly persistent in many examples of otherwise adult character. In figs. 12, 13, and 14 the adult form of the head of three other species of the genus is shown.

Glabella.—There is not as decided a change proportionally between the glabella of the smallest individual and that of the normal adult as there is in the outer contour of the head; still it is to be observed, that the dorsal furrows are not continuous but interrupted by the ocular ridges that cross them and unite with the frontal lobe of the glabella (figs. 2, 4, and 6), a feature unknown in the adult, that in the younger individuals the glabellar furrows extend entirely across the glabella, while in the older ones they are more or less interrupted or united only by very shallow transverse furrows at the center.

Eyes.—The usual form of the eye of the adult in this genus is shown in figs. 7, 8, 9, 12, and 14, where it is narrow, broadly arching outward, and with a more or less narrow palpebral lobe close to the glabella. In tracing the development of the eye of *Olenellus Howelli,* it is found, in the earliest stage with which we are acquainted, to be situated distant from the glabella toward the center of the cheek and united to the anterior lobe of the glabella by a strong ocular ridge that crosses and interrupts the continuity of the dorsal furrow (see fig. 2 and enlargement of fig. 1 on plate ix, fig. 15 *b*). There is considerable variation in the relative position of the eye and the length and strength of the ocular ridge in different examples of the head. In fig. 2 the ocular ridge of the left side is elevated, and with the high margin of the eyelobe partially incloses the depressed area within, while on the right side of the same individual both the ridge and eye are less elevated, and the ocular ridge being shorter the eye is brought in nearer to the glabella. In fig. 4 the ocular ridge is narrower at the point of union with the glabella and attached farther back near the posterior margin of the frontal lobe. Frequently the longitudinal axis of the eye is slightly oblique from its anterior end backward and outward. With the increase in size, these features usually disappear, although in fig. 6 there is an exception, as they are retained in a modified degree after other accompanying embryonic features of the head have disappeared. Between the eye and glabella, when the former is situated well out on the cheek, a small round or oval boss occurs, as shown in figs. 2, 3, 4, and 6.

Facial suture.—The course of the facial suture in front of the adult head is shown by the free cheek, fig. 17 (*s*). Of its variation from this course during the development of the individual nothing is known from actual observation, but from the fact that the relative position of the eye changes, it is probable almost to a certainty, that its direction is somewhat varied, and we know that such is the case in its direction back of the eye when the latter is situated out on the cheek or near the glabella. Back of the eye, in all the instances in which it has been observed, its direction is slightly outward, with a sigmoidal curvature to the angle of the posterior margin, or, in its absence, at the broad curve denoting the position of the angle about midway between the dorsal furrow and the genal angle, figs. 3, 4, 5, and 6. In the large adult specimens its course was probably as indicated by the traced line in fig. 9, where it is much the same as in the genus Ogygia or Dicellocephalus, and even more so in the cheek, fig. 17, if it cut the posterior margin at the angle *x*, as it does in all known cases in the smaller specimens, figs. 3, 4, 5, and 6. Comparing this with the direction of the stages of growth shown in figs. 3 and 4, where another generic group is suggested by its Paradoxides-like course, the contrast is very striking.

In the adult specimens of *Olenellus Gilberti* and *O. Vermontana* the course of the facial suture is almost directly backward from the eye to the margin, corresponding nearly to the line *o o*, of fig. 17, and terminating far within the angle *x*. That the course of the suture was the same in the larger heads of *O. Howelli* is not probable, as the head, fig. 6, shows it terminating at the place of the angle *x*. But the fact that in the closely allied species *O. Gilberti* the termination is between the angle and the dorsal suture would lead to looking for it there in *O. Howelli;* that its course, if not constant in the large adults, is as in fig. 6, only adds another anomalous feature to this strange species.

Mode of development.—The normal development of a trilobite from the earliest embryonic condition with which we are acquainted to the adult form is marked by the disappearance of the embryonic characters one by one as the individual increases in size and assumes more and more the features of the fully developed animal, all of which usually takes place, except in size and surface ornamentations, when it is quite small. The retaining of an embryonic feature after the individual has passed in size, or any other character, the stage at which it usually disappears in the regular course of the development of the species, is an exceedingly rare occurrence, and is unknown, to our own knowledge, except in the increase in size of the body in certain species, so that in their course of development certain individuals are in fact larger than those of the same species having a greater number of segments in the thorax and consequently more advanced in development. M. Barrande has shown this to be the case in the development of *Arethusina Konincki*, *Proetus decorus*, and *P. venustus*,[1] and we have observed it in *Triarthrus Becki*, where the relative size, proportional to the development, is very marked, *e. g.*, an individual with 13 segments in the thorax is 24^{mm} in length, and one with 16 segments but 16.5^{mm} long, while the fully-grown example of 16 segments reaches a length of 53^{mm}, and some with 13 segments are but 7^{mm} in length.[2]

This peculiarity of growth is shown in the species mentioned only by the thorax, for if we take the head apart from it there is little or nothing to prove that its size is not proportional to the stage of development; but in *Olenellus Howelli* the head proves this to be otherwise, and there may be added to the statement, that in certain species the size is not proportional to the number of liberated segments in the thorax, that in other species the size of the head is not always proportional to its stage of development. It is greatly to be regretted that the thorax and pygidium are not preserved, so that a direct comparison of those parts could be made with abnormal conditions of development in other genera and species.

Having shown that the peculiar development of this species, exhibited in the acceleration and retardation of growth in individuals as compared with each other, is in a measure comparable with the peculiarities of growth in some other species, a few of the questions arising from the study of the stages of growth observed will be spoken of as they are shown in the first nine figures on plate xxi.

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[1] Système Silurien de la Bohême, vol. i, p. 268, 1852.

[2] Trans. Albany Inst., vol. x. Fossils of the Utica Slate, p. 29, 1879.

It is impossible to imagine that the course of development was by size through figs. 1, 2, 3, 4, and 5; but if we take out the two forms figs. 2 and 4, those remaining, figs. 1, 3, 5, and 6, constitute a very good advancing series and the larger specimens, figs. 7, 8, 9, might be considered as illustrating the principle that the size is not proportional to the stage of development. The two forms taken out, figs. 2 and 4, however, prevent the first, if we consider them as belonging to the same species, as appears to be the case. They are associated with such forms as 3, 5, &c., and the two species *Olenellus Gilberti*, plate ix, fig 16, plate xxi, fig. 13, and *O. Iddingsi*, plate ix, fig. 12, in the same hard specimens of arenaceous shale, and, although fig. 2 is an extreme form, fig. 4 is a gradation in form to such forms as figs. 1 and 3. It is observed that figs. 7, 8, and 9 precede 6 in the stage of development of the contour of the head, at the same time showing a more accelerated development in the form of the eye. The eye of fig. 5 is more advanced than that of fig. 6, while the posterior outline of the head is more embryonic in its character. With these examples it is readily conceived that figs. 2 and 4 are enlarged examples of the forms that preceded fig. 1 in development, and the eye of fig. 2 supports this view, as it is, in its strongly developed ocular ridge, which is more marked than in fig. 1, and more anterior in relation to the frontal lobe of the glabella, essentially more embryonic; and the position of the genal angles and spines is either a decided embryonic feature, or a sport that, with fig. 4, to connect it with figs. 1 or 3, would not be considered as probable.

Was, then, the probable course of development of this species, before it reached the character of fig. 1, through earlier stages to a form like fig. 2, thence to figs. 4, 1, 2, 5, and so on to the adult?

In the development of *Olenellus asaphoides*, as given by Mr. Ford,[3] the youngest stage is about 2^{mm} in diameter and nearly circular in outline, the genal angles and spines are situated close in by the side of the facial suture, as it is subsequently developed, and there appears to be no doubt but that it is embryonic and representative of one of the earlier stages of growth of the species. The second stage, of which an outline figure is given on plate xxi, fig. 10, has changed somewhat, but the essential elements remain, and in fig. 11 there is a still greater expansion of the posterior margin of the head and the genal angles are carried slightly forward. There are probably several intermediate forms between figs. 10 and 11 that have not as yet been discovered, but for the present comparison they may be dispensed with, as in fig. 11 we have a form that may be compared in the contour of the head with our figs. 1 and 3; the genal angles are forward of the line of the posterior margin, and strong obtuse angles occur where the facial sutures cut the latter at *x x*. In fig. 12 the normal adult form of the head of this species is outlined. Reviewing the development thus hastily sketched, it is seen that the form fig. 11 is intermediate between figs. 10 and 12, and representative of the group of forms found in *O. Howelli*, between fig. 6 and the earlier forms preceding fig. 1 in size, fig. 6 being considered as nearest the adult type in the contour of the head. Without more data, it is, perhaps, conjectural to consider that the forms preceding fig. 1 were like figs. 2 and 4, and that preceding these the earlier stages of *O. asaphoides* were represented, the forms figs. 2, 4, 1, 3, 5 occupying the position in development taken by 11 in the latter species. At present no other view seems as reasonable, unless it is thought that fig. 2 represents the extreme embryonic tendency of the species, a course of development the reverse of that of *Olenellus asaphoides*, or any known species of the trilobita, and one not at all probable in this instance.

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[3] Amer. Journ. Sci., 3rd ser., vol. xiii, p. 265, figs. 1-4, 1877. *Ibid.*, vol. xxii, p. 250, 1881.

II. *Relations to other species and genera.*—The difficulty met with in comparing the abnormal development of this species with that of other species in which the thorax and pygidium are known is also felt in studying its relations to various species and genera in which the structure of the entire body is known, restricting as it does all comparisons to the head.

The species associated with *Olenellus Howelli* are *O. Gilberti*, plate ix, fig. 16, plate xxi, fig. 13, and *O. Iddingsi*, plate ix, fig. 12. The smallest head of the former, fig. 13, is about the size of fig. 2 of the same plate, but does not present the strong embryonic features of the latter. In comparison with the adult head of the same species, plate ix, fig. 16, it is observed that the eyes in the smaller individual are a little distant from the glabella and united to it by a very short ocular ridge; otherwise no embryonic features are indicated. The example of the head of *O. Iddingsi* is still smaller, but it does not present any recognized embryonic features.

Olenellus Gilberti and *O. Howelli* also occur at the same relative geologic horizon, at Pioche, Nevada, 130 miles (209.2 kilometers) distant. The former species in that locality is noticeable in having, in the smaller specimens observed, an obtuse angle in the posterior margin of the head midway between the genal angle and the glabella (see outline, fig. 14, plate xxi). In the larger specimens the angle is near the outer portion of the margin or a little within the postero-lateral angle. The facial suture back of the eye is quite unlike that of *O. Howelli*, as shown for the latter in figs. 5 and 6, and cuts the posterior margin between the angle, *x x*, of the margin and the glabella, as seen in figs. 14 and 17. In comparing with *O. Thompsoni* and *O Vermontana* Hall, from the Georgia slates of Vermont, it is only to be observed that in the former species the general features of the adult, as far as known, appear to be the same, and that in the latter the facial suture has the same course back of the eye as in *O. Gilberti*, and Prof. R. P. Whitfield has shown me a specimen in the collection of the American Museum of Natural History that is marked by a very short spine on the obtuse, rounded angle of the posterior margin, a short distance within the postero-lateral angle, a character not observed in any other species of the genus.

Mention has been made of *Olenellus asaphoides* and certain resemblances in the contour of its head at the stage of development represented by fig. 11, and that of the head of *O. Howelli* as seen in figs. 1, 3, 5, etc. The curious interocular spines of the former have not been seen in *O. Howelli*. Mr. Ford has called attention to the Paradoxides-like run of the posterior margin of the head, *g x*, *x g*, fig. 11, and states that it disappears altogether during the embryonic life of that species. We have shown that it is extravagantly developed in *O. Howelli*, even to the extent of changing the entire contour of the head, fig. 2, and that it persists in the adult stage of many individuals of this species, and is also present in *O. Gilberti* and *O. Vermontana*.

In all the observed specimens of *O. Howelli* showing the facial suture back of the eye the posterior margin is cut by it at the angle within the postero-lateral angle, as Mr. Ford has pointed out for the form, fig. 11, of *O. asaphoides*, and also in the genus Paradoxides.

Attention is again called to the direction of the facial suture back of the eyes, in figs. 3 and 4, and the position and obliquity of the eyes in relation to the median line of the glabella, characters of *Paradoxides*, as seen in *P. spinosus*. Of all the species of the latter genus, *P. Kjerulfi*[4] alone shows the presence of an ocular ridge uniting the eye and the frontal lobe of the glabella, fig. 15 (*a*), a feature so prominent in the young of *O. Howelli*, as well as the small, rounded protuberance between the eye and the glabella, shown in Linnarsson's fig. 2, of *P. Kjerulfi*. The latter character Mr. Ford discovered in the young of *O. asaphoides*, and noted its resemblance to the same in *P. Kjerulfi*. The ocular ridge, a feature in the latter that is permanent, is also present in the young of *O. Howelli*, but disappears in the adult, adding in this another link to the argument so admirably brought forward by Mr. Ford to show the genetic relation of the two genera.

Résumé.—The study of the head of *Olenellus Howelli* proves:

First. That in certain individuals of this species the existence of embryonic features continues long after the individual has reached the size at which such features are usually lost in the process of development of other species of the genus.

Second. That in individuals otherwise developed equally in all respects some one of them may have a characteristic feature, such as the eye or the genal angle, developed to a greater or less degree than in the others, and that this feature may persist even after the individual having it has passed in size or other characters the stage at which it is usually lost

Third. That the development of certain characters went on in an unequal degree in the corresponding parts of the same individual, and, finally, that certain features present in the younger individuals and disappearing during the subsequent growth are permanent features in some species of the genus Paradoxides.

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[4] **Öfversigt af Kongl. Vetenskaps-Akademiens Förhandlingar, N:o. 6, Stockholm, p. 790, Tafl. xvi, figs. 1, 2. 1871.**

Genus DICELLOCEPHALUS Owen.

Dicellocephalus bilobatus H. & W.

Dicellocephalus bilobatus Hall & Whitfield, 1877. Geol. Expl. Fortieth Parallel, vol. iv, p. 226, pl. 2, fig. 36.

This species was founded on a pygidium having a bilobed posterior border, collected in the Eureka District by the geologists of the Fortieth Parallel Geological Survey. The same character of pygidium was obtained by the present survey in the upper beds of the Cambrian, on the east side of the Sierra Valley, east of Pinnacle Peak, Eureka District, Nevada.

Dicellocephalus Osceola Hall.

Plate ix, fig. 25.

Dikelocephalus osceola Hall, 1863. Sixteenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 146, pl. x, fig. 18; pl. vii, fig. 49?

Original type from the Potsdam sandstones at Osceola Mills, State of Wisconsin.

A comparison of the Nevada specimens, consisting of the glabella and fixed cheeks, with the type example of the species in the American Museum collection, shows such a strong specific identity of the parts preserved that there is little doubt, with our present information, but that they belong to one and the same species.

Formation and locality.—Cambrian. Prospect Mountain Group, upper portion, on ridge north of the Dunderberg mine, Eureka District, Nevada.

Dicellocephalus nasutus, n. sp.

Plate x, fig. 15.

Glabella and fixed cheeks, when united, subquadrangular in form, the width being about three-fourths of the length. The glabella is broadly conical, rounded in front, and with its convex surface marked by two slightly impressed pairs of anterior furrows, and a pair of more strongly marked posterior furrows that penetrate obliquely inward to a shallow transverse furrow that unites them; occipital ring of medium width and separated from the glabella by a well-defined, but not deeply impressed occipital furrow; dorsal furrows of medium strength on the sides of the glabella but scarcely shown in front; fixed cheeks unusually narrow and rising directly up to the large, elongate palpebral lobes; anteriorly they slope into the groove of the frontal limb; posterior extension and postero-lateral limbs unknown; frontal limb between the glabella and furrow nearly obsolete, extending beyond the furrow as a broad subspatulate, somewhat convex margin. The facial suture curves a little outward in front of the eye as far as the furrow of the frontal limb and then recurves inward around to the front; after curving around the large eyelobe to near the posterior margin, its further course has not been traced.

Surface smooth or slightly punctate.

Thorax and pygidium unknown.

Formation and localities.—Cambrian. Prospect Mountain Group, central portion Secret Cañon shale in New York Cañon, and upper layers of same on north side of the cañon opposite the dump of the shaft of the Richmond mine, Ruby Hill, Eureka District, Nevada.

Dicellocephalus Richmondensis, n. sp.

Plate x, fig. 7.

Glabella and fixed cheeks, united, quadrangular in form, the width being a little greater than the length. Glabella elongate-subquadrangular, lateral margins slightly converging anteriorly, and with the front a little rounded; length and breadth as three to four; surface moderately convex, and marked by a slightly impressed posterior pair of furrows, directed obliquely inward two-thirds the distance to the median line, and two pairs anterior to these that are just discernible upon the smooth surface; occipital ring of medium width, distinct; occipital furrow distinct, but not deeply impressed; dorsal furrows well defined at the sides but only a line in front of the glabella; fixed cheeks broad, rising slightly from the dorsal furrows to the palpebral lobes and sloping away before and behind quite rapidly; frontal limb rather long and wide, the marginal rim broadly arcuate, the width more than one-half the length of the limb between it and the glabella, somewhat flattened and with a narrow groove between it and the depressed limb; posterior lateral limbs narrow, marked by the extension of the occipital furrow within their posterior margin. The facial sutures cut the frontal rim obliquely, and recurving inward pass to the palpebral lobes; curving around these opposite the central portion of the glabella, they then extend obliquely outward and backward, cutting the posterior margin beyond a line with the eyelobes.

Surface smooth to the unaided eye; minutely punctate under a strong magnifying power.

This species is distinguished by its broad fixed cheeks and long frontal margin with the flattened rim.

Formation and locality.—Cambrian. Prospect Mountain Group, upper beds of the Secret Cañon shale, on the opposite side of the cañon from the dump of the shaft of the Richmond mine, Ruby Hill, Eureka District, Nevada.

Dicellocephalus ? angustifrons, n. sp.

Plate x, figs. 1, 1*ab*.

Glabella subquadrate; width at the base equal to the length, but nearly one-third greater than the width of the anterior margin; surface moderately convex, curving down in front and marked by two pairs of lightly impressed glabellar furrows that extend obliquely inward one-third the distance across the glabella, the posterior pair nearly separating the posterior triangular lobes; occipital ring rather broad and distinctly defined by a strong occipital furrow; dorsal furrows narrow but strongly impressed; fixed cheeks very narrow and hardly separable from the palpebral lobes, which are large, elongate, and situated opposite the central portion of the glabella; frontal limb merely a line between the glabella and the rounded rim; lateral limbs only partly known; they appear to be narrow and rather short.

Associated with the glabella and fixed cheeks are numerous free cheeks that undoubtedly belong to this species. They are triangular with the upper angle truncated to form the base of the eyelobe; the outer margin is strong, somewhat flattened, and separated from the rapidly ascending slope to the furrow at the base of the eye by a sharp narrow groove. The union of the free cheeks with the fixed cheeks would give the head a semicircular, strongly convex form, with rounded postero-lateral angles. The pygidium occurring with the other parts is transversely elliptical, about one-third wider than long, and elevated on the median lobe; the frontal margin is broadly rounded, the lateral margins scarcely angular at the union of the frontal margin and the more sharply rounded posterior line; axial lobe elevated, convex, about one-half the length of the pygidium, and marked by six transverse rings, including the terminal one; lateral lobes broad, sloping rapidly away from the axial lobe and then spreading out in a broad, flattened border; their surface is marked by three broad anchylosed segments, besides the narrow anterior articulating projection and the broad posterior termination.

Surface of the head finely granulose, and the pygidium the same, with the exception of the irregular striæ on the border, the latter are subparallel to the margin.

This species in the general form of the head and pygidium resembles many species referred by Mr. Billings to his genus Bathyurus, but it is nearer Dicellocephalus, if we compare it with typical forms of the genus from the Potsdam sandstone of Wisconsin, and is referred to that genus provisionally.

Formation and localities.—Cambrian. Prospect Mountain Group. Summit of Hamburg shale, on the ridge north of the Dunderberg mine, and in a matrix of a similar character at the southeast base of Lookout Mountain, Sierra Cañon, Eureka District, Nevada.

Dicellocephalus Iole, n. sp.

Plate x, fig. 19.

Glabella subquadrate, length exclusive of the occipital ring equal to the width at the base; it narrows a trifle anteriorly, is transverse in front, and has its lateral angles rounded; surface gently convex, rounding downward in front, and marked by two pairs of rather strong, but not deeply impressed, furrows that extend obliquely inward well towards the median line.

Occipital ring narrow, flattened; occipital furrow very shallow; fixed cheeks narrow, separated from the glabella by distinctly marked dorsal furrows, and sloping rapidly from the palpebral lobes before and behind; palpebral lobes elongate, slightly sinuate, and with a groove within the margin; frontal limb broad, rather short, sloping down to a line or groove beyond which the flattened margin extends, the width of the margin nearly equaling the distance between it and the glabella; postero-lateral limits of medium width, with the extension of the occipital furrow marking their posterior portion; their lateral extension is a little greater than one-half the length of the head.

Facial suture directed outward from in front of the eyelobe to the anterior rim of the head, around which it abruptly curves, terminating at the front margin; behind the eye it passes obliquely backward at an angle of 25° with the posterior margin of the head, cutting the latter at a distance from the dorsal furrow equal to the width of the anterior end of the glabella.

Surface finely granulose under a strong magnifying glass.

Thorax and pygidium unknown. One associated pygidium is much like that illustrated by Hall and Whitfield, Geol. Expl. Fortieth Par., vol. iv, pl. i, fig. 39.

Formation and locality.—Cambrian. Upper portion of Prospect Mountain Group, near the Bullwhacker mine, Eureka District, Nevada.

Dicellocephalus Marica, n. sp.

Plate x, fig. 13.

Glabella and fixed cheeks subquadrate in outline, narrowing somewhat towards the front. Glabella subquadrangular and almost squarely truncate in front, which is not quite as wide as the base; strongly convex, and marked by three pairs of furrows, the two anterior pair but slightly impressed and very short; the posterior pair extend obliquely inward one-third the distance across from each side, and are united by a slight transverse furrow; occipital ring strong and elevated; occipital furrow well defined; dorsal furrows strongly impressed; fixed cheeks moderately convex, narrow in front, widening at the palpebral lobes, and sloping away rapidly in front, and less so back of the eyelobes; eyelobes narrow, semicircular, and situated opposite the central portion of the glabella; frontal limb obsolete except the round, thick, marginal rim just in advance of the glabella; the posterior limbs are broken away at a little distance from the dorsal furrows.

Surface, as seen under a strong magnifying glass, with fine inosculating, flattened lines surrounding minute round or irregularly oval spaces.

Formation and locality.—Upper beds of the Cambrian just south of the Hamburg mine, and in the same cañon, Eureka District, Nevada.

Dicellocephalus ? quadriceps H. & W.

Plate ix, fig. 24.

Dikellocephalus ? quadriceps Hall & Whitfield, 1879. Geol. Expl. Fortieth Parallel, vol. iv, p. 240, pl. i., figs. 37–40.

Type specimens from the base of Ute peak, Wahsatch Range, Utah.

A careful comparison of the Wahsatch specimens with those from Nevada fails to give sufficient specific distinction to separate them on the evidence afforded by the material at hand. A small glabella with portions of the fixed cheeks attached is figured on plate ix, fig. 23, to show the peculiar form of the glabella and the disappearance of the very faint glabellar furrows, scarcely shown in the specimens from Utah; this represents one extreme of the species, while the specimen illustrated in the Paleontology of the Geological Exploration of the Fortieth Parallel exhibits the other, or more mature form.

The generic reference is open to question, but with our present material little more can be done with it.

Formation and localities.—Cambrian. Prospect Mountain Group, base of Secret Cañon shale, New York Cañon, and in Cambrian limestone on the west side of the Eureka District on the Antelope Valley slope, near the plain, Eureka District, Nevada.

Dicellocephalus ? expansus, n. sp.

Plate ix, fig. 19.

Glabella elongate subquadrangular, or subclavate, the base about one-fifth narrower than the front; surface convex and without perceptible furrows; occipital furrow distinctly defined; occipital ring strong, with a small spine on the center of the posterior portion; dorsal furrows well defined along the sides of the glabella; fixed cheeks of medium width, palpebral lobes unknown; an ocular (?) ridge crosses the anterior portion of the right fixed cheek, so as to indicate a moderate sized eyelobe between it and the postero-lateral limb; frontal limb as a narrow rim; postero-lateral limbs rather narrow, extended and marked by a strong furrow within the posterior margin.

Surface finely punctate.

This species and the preceding are closely related, judging from the parts which we have for comparison. It is hoped that in some more favorable locality entire specimens may be obtained of these and the many other species known only by fragments, so that the generic characters can be determined with greater certainty and more positive specific references made.

Formation and localities.—Cambrian. Prospect Mountain limestone at base of Secret Cañon shale, in New York Cañon, and also in a small exposure of Cambrian limestone on the west side of the Mahogany Hills, in Antelope Valley, Eureka District, Nevada.

Genus PTYCHOPARIA Corda.[5]

Ptychoparia (?) Prospectensis, n. sp.

Plate ix, fig. 20.

The general outline of the head is moderately convex, semicircular, the width being about twice the length.

The glabella is subconical, truncate in front and marked by three pairs of short, slightly impressed glabellar furrows; occipital ring distinctly defined by a narrow, lightly impressed occipital furrow; fixed cheeks broad, of equal elevation with the glabella, and extending beyond it anteriorly, the space between them on the broad frontal limb being taken by a small swelling or boss that, but for the slight transverse dorsal furrow between it and the glabella, might be mistaken for a continuation of the latter; the eyelobes are comparatively large for a species of this character and occupy a prominent position on the outer margin of the cheeks, a distinct ocular ridge crossing the latter from the anterior margin of the eyes to the dorsal furrow on a line with the front of the glabella; the lateral limbs are narrow, rather short, and slope rapidly downward back of the eyelobes; frontal limb broad at the center, narrowing in front of the fixed cheeks and bordered anteriorly by a not very distinctly defined rounded margin. The facial suture curves a little inward in front of the eye and appears to terminate on the front line somewhat in advance of a line passing through the center of the tubercle in front of the glabella; behind the eye it extends obliquely outward and backward to the posterior margin of the head, outlining an elongate triangular postero-lateral limb.

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[5] The reason for using the generic term Ptychoparia rather than Crepicephalus, as used by Messrs. Hall and Whitfield in the Paleontology of the Fortieth Parallel Exploring Expedition, is given in a bulletin of the Geological Survey now ready for the press, entitled a "Review of the Fauna of the St. John Formation." The relations of the genera Conocoryphe, Ptychoparia, Crepicephalus, Solenopleura, Liostracus, and Conocephalites are mentioned.—C. D. W.

Under a strong magnifying power the surface is seen to be finely granulose.

Free cheeks, thorax, and pygidium unknown.

Formation and locality.—Cambrian. Mountain shale band of the Prospect Mountain Group, on the east slope of Prospect Peak, Eureka District, Nevada.

Ptychoparia (?) Linnarssoni, n. sp.

Plate ix, figs. 18, 18*a*.

The glabella and fixed cheeks are the only portions of this interesting species that have been identified. The glabella is small in proportion to the area occupied by the cheeks and frontal limb; it is conical in form, truncate in front, moderately convex, and marked by three pairs of very short, slightly impressed glabellar furrows; the latter only observed on very perfect specimens; occipital ring narrow, as also the shallow occipital furrow; fixed cheeks broad, elevated, and projecting forward on to the frontal limb considerably in advance of the front of the glabella, the included space between their anterior portions being occupied by an elongate oval boss that is separated from the glabella by a rather broad, shallow furrow; the boss or tubercle extends to the rounded thick frontal rim, from which it is defined by a scarcely perceptible depression; dorsal furrows broad, well defined, and running out in front much broader between the tubercle and the fixed cheeks; palpebral lobes rather prominent and situated opposite the anterior end of the glabella; postero-lateral limbs long, triangular, and marked by a strong furrow within their posterior margin. Facial suture directed forward in front of the eyelobes, curving outward a trifle and then a little inward on the frontal limb, around the front of which it does not appear to extend; back of the eyelobe it extends obliquely outward and backward, bending a little more abruptly backward towards the lateral extension of the limb, terminating at or just within the genal angle at a distance from the dorsal furrow equal in one example to the entire length, and in another to two-thirds of the length of the head.

Surface minutely granulose.

The specific name is given in honor of Dr. G. Linnarsson, the eminent Swedish paleontologist.

This species is allied to *P. Prospectensis*, but differs in the position of the eyelobes and the larger frontal limb, changes, however, that may be only varietal, as there is an interval of 3,000 feet of strata between the horizons at which they respectively occur, but for the present they are regarded as distinct species. They are strongly marked forms and types of a group of the genus not specially recognized heretofore, as they unite the presence of a tuberosity in front of the glabella, seen only (with the exception of *Ptychoparia calymenoides* Whitfield) in the eyeless trilobites, *Conocoryphe coronatus* Barr., *C. exsulans* Linnarsson, *C. Matthewi* Hartt, *C. Solvensis* Hicks, *C.* (*Elyx*) *laticeps* Angelin, with the presence of fully-developed eyes and the direction of the facial sutures as in *Ptychoparia striatus*, etc. I am not at all certain that *P. calymenoides* should be included with them, as the tuberosity in that species may be only an unusual thickening of the frontal rim of the head and not the true frontal limb, a question not readily determined with the specimens thus far obtained

Formation and locality.—Cambrian. Prospect Mountain Group, in the upper beds of the Secret Cañon shale, on the east side of Secret Cañon, opposite the Geddes and Bertrand mine, Eureka District, Nevada.

Ptychoparia (Solenopleura ?) breviceps, n. sp.

Plate x, fig. 9.

Head rather small, convex, semicircular; length a little less than one-half the width of the posterior margin. Glabella large, prominent; length and width at the base nearly equal, converging rapidly towards the truncated front to three-fifths the width of the base; the posterior glabellar furrow extends entirely across, while the two anterior pairs are scarcely discernible; occipital ring transverse, rounded, separated from the glabella by a strong, rounded furrow, and extending laterally as the narrow rounded posterior border of the head; dorsal furrows strongly defined; fixed cheeks convex, depressed below the level of the glabella, rather wide and sloping abruptly to the frontal border, slightly depressed towards the small palpebral lobes and sloping away rapidly posteriorly; ocular ridges strongly marked, trending obliquely backward from the antero-lateral angles of the glabella; postero-lateral limbs rather narrow, distinctly grooved on the posterior edges by the occipital furrows; frontal limb obsolete, the strong, rounded, marginal border touching the anterior margin of the glabella. Facial suture curves slightly inward in its course from the eyelobe to the front margin of the head, and apparently cuts obliquely inward across the frontal rim; behind the eye it is directed outward, curving a little backward to the posterior margin and outlining an elongate triangular lateral limb.

Surface apparently smooth or very finely punctate.

Formation and locality.—Cambrian. Prospect Mountain Group, in the Hamburg shale belt north of Adams Hill, Eureka District, Nevada.

Ptychoparia (?) pernasutus, n. sp.

Plate x, figs. 8, 8 *a–b*.

Entire form unknown. The glabella and fixed cheeks, and the free cheeks associated with them, give the head a rounded, subtriangular form; it is strongly convex and produced anteriorly in a strong, elongate, flattened triangular process, the anterior third of which bends downward with a uniform curvature; the width of the process at the base is about two-thirds of its length from the marginal furrow; laterally it passes into the strong rounded border of which it is an extension.

Glabella strongly convex, broadly conical in outline and rounded truncate in front; the greatest breadth near the base is five-sixths of the length from the occipital furrow to the front; three pairs of furrows divide it into three posterior subequal lobes and one smaller anterior lobe; the posterior furrows penetrate obliquely backward nearly two-thirds the distance to the median line, while the two anterior pairs are short and but slightly impressed; occipital furrow broad and well defined, with a small triangular-shaped node at each postero-lateral angle of the glabella; occipital ring strong and narrowing towards the dorsal furrows. Only small portions of the fixed cheeks are preserved; these show the presence of strongly-defined dorsal furrows around the glabella, and that the cheeks sloped up rapidly from them towards the palpebral lobes, which, from the associated free cheek, must have been of rather large size and not far from the glabella, giving a somewhat narrow fixed cheek; the anterior limb has a length of about one-fifth of that of the glabella from the occipital furrow, it is slightly convex and slopes into the rather strong furrow between it and the nasute-like extension of the marginal border, its anterior margin forming an obtuse angle at the median line.

The associated free cheek is subtriangular in outline, strongly convex, with a wide, strong marginal border and groove, and a spinous extension of the genal angle, with the anterior margin extended beyond the union of the cheek with the margin, the interior angle is hollowed out for the reception of a large eyelobe.

Surface granulose and probably pustulose on the glabella.

This is a large and unusually striking species. In the extension of the frontal border it is like *Anomocare acuminatum* Angelin, a feature not heretofore observed in any American species from this horizon.

Formation and locality.—Summit of the Cambrian, Prospect Mountain Group, east side of the cañon east of the Hamburg Ridge, Eureka District, Nevada.

Ptychoparia (Euloma ?) dissimilis, n. sp.

Plate ix, fig. 28.

Glabella prominent, strongly convex, the anterior lobe curving downward and under to the frontal margin; length and width at the base equal; marked by two pairs of glabellar furrows extending obliquely inward, the posterior pair nearly cutting off the triangular-shaped posterior lobes; occipital ring broad at the center, narrowing laterally; occipital furrows strongly impressed, as are the dorsal furrows along the sides of the central and posterior portions of the glabella; fixed cheeks very narrow; palpebral lobes large, moderately elongate, slightly sinuous, with a strong groove within the margin; frontal lobe a narrow rounded rim; postero-lateral limbs unknown.

This species is known only by the parts mentioned. It is allied to *Ptychoparia Eos* Hall, and a somewhat similar form has been described as *Menocephalus Sedgwicki* Billings. They appear to form a small group of the Conocephalidæ, the limits of which have not been defined. The reference to the genus Menocephalus is of doubtful propriety, since, up to the present time, the fragment referred to as the type by Owen has never again been even generically or specifically recognized in all the great collections from the Potsdam sandstone of the Wisconsin and Minnesota, and it appears to be practically impossible to identify it. The two species referred to the genus by Billings, Palæozoic Fossils, vol. i, p. 407, and Geology of Canada, p. 237, also appear to belong to two distinct genera.

Formation and locality.—Cambrian. Secret Cañon shale of the Prospect Mountain Group, New York Cañon, Eureka District, Nevada.

Ptychoparia occidentalis, n. sp.

Plate x, fig. 5.

Head within the facial sutures, exclusive of the postero-lateral limbs, quadrangular in form; glabella subconical, the sides slightly converging towards the rounded front; surface uniformly convex and marked by three pairs of moderately oblique glabellar furrows, the two posterior pairs of which are more strongly impressed and reach two-thirds the distance to the median line, the anterior pair are short and faintly defined; occipital furrow distinct; occipital ring rounded and rather under the medium size; dorsal furrows well impressed on the sides and in front of the glabella; fixed cheeks of medium width, not very convex, and sloping away gradually in front and behind; ocular ridges well marked; frontal limb extended a little beyond the fixed cheeks, slightly convex, and bordered by a flattened rim that is two-thirds as wide as the width between it and the glabella; eyelobes of medium size; postero-lateral limbs narrow, extended, with a strongly marked continuation of the occipital furrow just within their posterior margin. The facial suture cuts very obliquely across the frontal rim of the head and abruptly recurving inward at its interior margin passes slightly inward in a direct line to the eyelobe, back of which it is directed outward with a backward curve on the outer third of the lateral limb, to the posterior margin of the head, which it cuts at a distance from the dorsal furrow equal to the width of the base of the glabella.

Surface of head finely granulose; striate on the frontal limb.

In the general outline of the facial sutures this species might be referred to Dicellocephalus, but the glabella is of the true type of Ptychoparia, and the other parts are not incompatible with a reference to that genus.

Formation and locality.—Cambrian. Prospect Mountain Group, at the base of the Secret Cañon shale on the west side of Secret Cañon, Eureka District, Nevada.

Ptychoparia similis, n. sp.

Plate x, fig. 10.

The glabella and fixed cheeks form a subquadrangular outline, with the central portion, opposite the eyes, arching inward, the frontal and postero-lateral limbs terminating the angles; glabella broadly conical, sides straight, converging slightly anteriorly to the rounded frontal margin; surface strongly convex and broken by three pairs of furrows, the anterior of which are very faint, the middle pair somewhat stronger and the posterior still more so; all are deflected a little backward, the posterior pair strongly outlining the posterior lobes; occipital ring strong and full and separated by a deeply impressed occipital furrow; dorsal furrows distinct at the front and sides of the glabella; fixed cheeks narrow and rising rapidly from the dorsal furrows to the palpebral lobes, sloping away somewhat abruptly to the front and back; frontal limb short and broad, convex, and sloping quite rapidly to the slight furrow within the broad, planulate margin, which appears to be a continuation of it; postero-lateral limbs narrow, posterior margins rather strong, with a narrow groove within.

Surface of the glabella finely pustulose.

This species is allied to *P. Montanensis* Whitfield, but differs in the character of the frontal limb very decidedly, as also in the planulate margin. Some of the examples show the front margin cut away by the suture line which crosses it obliquely from about one-third the distance from the center, at its front margin, to the postero-lateral angle.

Formation and locality.—Cambrian. Prospect Mountain Group, in the upper beds of the Secret Cañon shale across the cañon opposite the northeast dump of the Richmond mine shaft, Ruby Hill, Eureka District, Nevada.

Ptychoparia similis, var. robustus, n. var.

Plate i, figs. 9, 9 *a*.

Glabella and fixed cheeks subquadrangular in outline. Glabella obtusely conical, sides slightly converging to the rounded front; surface convex, marked by two pairs of rather short, slightly impressed, oblique furrows; occipital ring strong, with a well-defined occipital furrow; dorsal furrows well defined in front and at the sides of the glabella; fixed cheeks narrow, rising rather rapidly from the dorsal furrows up to the front of the small palpebral lobe and then arching over to unite with the short, rounded frontal limb; ocular ridges well marked; frontal margin rather broad and flat; postero-lateral limbs narrow as in *P. similis*. Surface of the glabella and postero-lateral limbs finely pustulose.

This species, in the parts preserved, is closely allied to *P. similis*. The glabella is shorter, more convex, and nearly as broad as long, while that of *P. similis* is one-fourth longer than broad. The entire appearance gives the idea of its being a robust form of *P. similis*.

Formation and locality.—Same as *Ptychoparia similis*.

Ptychoparia (Euloma?) affinis, n. sp.

Plate x, fig. 12.

General form and appearance much like that of *P. similis*, but differing in its more pronounced convexity, in the more deeply impressed two posterior pairs of glabellar furrows and the rounded marginal rim instead of the long planulate margin; features that render the two very distinct. Surface finely pustulose. Mr. E. Billings has described an allied form from Canada as *Menocephalus Sedgwicki*, the generic reference of which is very doubtful.

Formations and localities.—Cambrian and Silurian. In the limestones or passage beds between the Prospect Mountain and Pogonip Groups above the Hamburg belt of shale east of the Hamburg mine, and in the limestone of a little higher horizon northeast of Adams Hill, Eureka District, Nevada.

Ptychoparia lævioeps, n. sp.

Plate x, figs. 17, 18.

General form of head within the facial sutures subtrapezoidal. Glabella conical, strongly convex, with very faintly defined dorsal furrows separating it from the rapidly sloping fixed cheeks; two pairs of furrows are just discernible by slight impressions on the surface; occipital ring strong, rounded, separated from the glabella by a shallow furrow; fixed cheeks of medium width, sloping rapidly down from the glabella and from the small eyelobe, situated a little back of the center, to the front and back; frontal limb short, convex, and depressed to the broadly rounded, strong, marginal rim; postero-lateral limbs rather strong and running out beyond the line of the lateral extension of the frontal limb.

Surface smooth to the unaided eye; under a strong magnifying power, minutely granulose.

This species is peculiar in the absence of strongly marked furrows and the general smooth appearance, as though all strong outlines had been removed by rubbing off the outer surfaces. In form it resembles the following species and is closely allied to it. It differs from it in the general appearance and also in the course of the facial sutures in front of the eyes.

Formation and locality.—Cambrian. Prospect Mountain Group, upper beds of the Secret Cañon shale on the east side of Secret Cañon, Eureka District, Nevada.

Ptychoparia Oweni M. & H.

Plate x, figs. 3, 3 *a*.

Arionellus (*Crepicephalus*) *Oweni* Meek & Hayden, 1861. Proc. Acad. Nat. Sci. Philad., vol. xiii, p. 436.

Arionellus ? Oweni Meek & Hayden, 1862. Amer. Jour. Sci., 2d Series, vol. xxxiii, p. 74.

Agraulos Oweni Meek & Hayden, 1864. Pal. Upper Missouri, p. 9, figs. A, B, C.

Agraulos ? Meek & Hayden, 1864. Pal. Upper Missouri, p. 10, pl. i, fig. 4.

Conocoryphe (*Ptychoparia*) *Gallatinensis* Meek, 1873. Sixth Ann. Rep. U. S. Geol. Surv. Territories, for the year 1872, p. 485.

Crepicephalus (*Loganellus*) *centralis* Whitfield, 1877. Prelim. Rep. Pal. Black Hills, p. 10.

Crepicephalus centralis Whitfield, 1881. Rep. Geol. and Resources Black Hills of Dakota, p. 341, pl. ii, figs. 21, 24.

I was somewhat surprised on bringing together the types of *Arionellus* = *Ptychoparia Oweni*, *Conocoryphe* = *Ptychoparia Gallatinensis*, and *Crepicephalus* = *Ptychoparia centralis*, to find that they were representatives of one somewhat variable species. The types of *P. Oweni* and *P. centralis* are absolutely identical, while *P. Gallatinensis* is only a variety of *P. Oweni* that shows a wider range of variation, owing to the fact that we have a larger series of specimens representing it. One of these variations is shown in the Black Hills specimen figured by Meek and Hayden as *Agraulos ?* ————, and labeled (probably by Mr. Meek) in the collection of the Smithsonian Institution as *Conocephalites* sp. ?

The Nevada species is the same as that from the Gallatin River, Montana, and the Black Hills of Dakota. It presents much the same variations in size, and the presence or absence of the glabellar furrows is a noticeable feature in each. Some of the younger specimens resemble *Conocephalites* = *Ptychoparia arenosus* Bill., from the Potsdam sandstone of Vermont, but differ in the width of the fixed cheeks and frontal limb.

P. Oweni ranges through nearly 4,000 feet of strata, being found in the Prospect Mountain limestone of the 700-foot level of the Richmond mine and well up in the Pogonip Group on the ridge east of the Hamburg mine, and at various horizons between the two in New York, Secret, and Sierra Cañons, and on the Hamburg Ridge. In the Black Hills it occurs at about the horizon of the upper portion of the Prospect Mountain Group of the Eureka District, Nevada.

In a report on the Cambrian fauna of the United States, now in course of preparation, the types of the various species given in the synonymy of *Ptychoparia Oweni* will be illustrated

Ptychoparia Anytus H. & W.

Plate ix, fig. 26.

Crepicephalus (*Loganellus*) *anytus* Hall & Whitfield, 1877. Geol. Expl. Fortieth Par., vol. iv, p. 219, pl. ii, figs. 19–21.

Compare *Crepicephalus*=*Ptychoparia planus* Whitfield, 1877. Geology and Resources of the Black Hills of Dakota, p. 341, pl. ii, figs. 21–24. Also *Crepicephalus* (*L.*) = *Ptychoparia Montanensis* Whitfield, 1876. Rep. Recon. Carroll, Montana, to Yellowstone Nat. Park, Ludlow, p. 141, pl. i, figs. 1, 2.

The specimen illustrated by fig. 26 of plate ix, differs from the type of *P. Anytus* in having a somewhat narrower, more quadrilateral glabella, and also a thicker anterior rim to the head, but on comparing several specimens with the typical specimens from Schell Creek, Nevada, these variations are seen in each series, and no satisfactory differences remain upon which to base a distinct species. The figure given by Messrs. Hall and Whitfield shows a larger, broader, and more conical glabella in proportion to the head than that of fig. 26, plate ix, of this report, the two figures in the two reports giving the range of variation in the head as far as known.

On comparing the type of *P. planus* Whitfield, with a head of *P. Anytus*, broken just as the type of *P. planus* is, there does not appear to be the slightest difference between the two. We labor, however, under the disadvantage of comparing with a cast of a fragment of the head as the original type, and cannot decide positively until more and better material is collected from the original locality.

P. Montanensis is a closely allied species of which we have not seen the original type.

Formation and locality.—Cambrian. In the upper beds of the Secret Cañon shale, on the east side of New York and Secret Cañons, Eureka District, Nevada.

Ptychoparia granulosus H. & W.

Crepicephalus (*Loganellus*) *granulosus* Hall & Whitfield, 1877. Geol. Expl. Fortieth Par., vol. iv, p. 214, pl. ii, figs. 2, 3.

Types from the Eureka District. The species occurs at the summit of the Secret Cañon shale, across the cañon from the dump of the Richmond shaft, Ruby Hill, and in the lower part of the Pogonip Group, southeast of the Jackson mine, Eureka District, Nevada.

Ptychoparia Haguei H. & W.

Crepicephalus (*Loganellus*) *Haguei* Hall & Whitfield, 1877. Geol. Expl. Fortieth Par., vol. iv, p. 210, pl. ii, figs. 14, 15.

Types from Pogonip Mountain, White Pine District, Nevada.

In the Eureka District this species has a range nearly equal to that of *P. Gallatinensis*, but, as yet known, it does not extend down below the summit of the Secret Cañon shale. At that horizon it occurs on the eastern side of Secret Cañon and the opposite side of the cañon from the dump of the Richmond shaft, Ruby Hill, and at the summit of the Hamburg shale east of the Hamburg mine, and also in the lower part of the Pogonip Group at the same locality.

Ptychoparia nitidus H. & W.

Crepicephalus (*Loganellus*) *nitidus* Hall & Whitfield, 1877. Geol. Expl. Fortieth Par., vol. iv, p. 212, pl. ii, figs. 8–10.

Crepicephalus (*Loganellus*) *simulator* Hall & Whitfield, 1877. Geol. Expl. Fortieth Par., vol. iv, p. 218, pl. ii, figs. 16–18.

When studying a large series of specimens of *Ptychoparia nitidus* it was observed that the head and pygidium varied in size, and that there were no differences between the larger sized specimens of the head and the type of *Crepicephalus* (*L*) *simulator*.

The types of the two species described by Messrs. Hall and Whitfield were collected in the Eureka District by the geologists of the Fortieth Parallel Exploring Expedition, and the species is quite abundant in strata near the summit of the Cambrian series.

Formation and localities.—Hamburg shale, in the Widewest Ravine north of Adams Hill, and also from the same horizon a short distance south of the Hamburg mine on the east side of the same cañon, Eureka District, Nevada; also at about the same horizon on Pogonip Ridge, White Pine District, Nevada.

Ptychoparia unisulcatus H. & W.

Crepicephalus (*Loganellus*) *unisulcatus* Hall & Whitfield, 1877. Geol. Expl. Fortieth Par., vol. iv, p. 216, pl. ii, figs. 22, 23.

The types of this species are cited by its authors as coming from the limestone of the Potsdam Group at Eureka, Nevada. It is found associated with *P. Haguei*, in the upper beds of the Secret Cañon shale, opposite the dump of the Richmond mine shaft, Ruby Hill, on the northeast side of the cañon, and in the lower portion of the Pogonip Group, northeast of Adams Hill. It also occurs in the lower portion of the Pogonip Group, on Pogonip Ridge, White Pine District, Nevada.

Subgenus PTEROCEPHALUS Roemer.

Ptychoparia (Pterocephalus) occidens, n. sp.

Plate ix, fig. 21.

Glabella and fixed cheeks, when united, irregularly elongate-quadrangular in outline, exclusive of the postero-lateral limbs; widest across the frontal lobe, and curving in towards the eyelobes; greatest width five-sixths of the length. Glabella broadly conical, rounded in front, and moderately convex; marked by a pair of short posterior furrows.

Occipital ring narrow, rounded, separated from the base of the glabella by a narrow, distinct occipital furrow; fixed cheeks rather narrow; palpebral lobes small, and situated opposite the central portion of the glabella; frontal limb expanded, its length equaling more than one-third the entire length of the head; concave from the front to the back, and apparently without a raised anterior rim; postero-lateral limbs extended, the suture line cutting the posterior margin some distance beyond the line of the eyelobes; marked near the posterior margin by the extension of the occipital groove. Facial suture extends outward, with a slight curvature in front of the eyelobe, and then recurves, rounding the lateral extension of the frontal limb; behind the eye it extends backward and outward at an angle of about 45° for a short distance, and then continues at an angle of 25° to the posterior margin of the head.

Dimensions.—Length of head, 6^{mm}; breadth of frontal lobe, 2.25^{mm}; length of glabella, including occipital ring, nearly 3.75^{mm}.

This distinct form appears to belong to that division of the Concephalidæ represented by Roemer's genus Pterocephalus, judging by its wide frontal limb and the course of the facial sutures.

Formation and locality.—Upper beds of the Cambrian. On the east side of the cañon east of the Hamburg Ridge, Eureka District, Nevada.

Ptychoparia (Pterocephalus) laticeps H. & W.

Conocephalites (*Pterocephalus*) *laticeps* Hall & Whitfield, 1877. Geol. Expl. Fortieth Par., vol. iv, p. 221, pl. ii, figs. 4–7.

This species is given by its authors as occurring in the lowest limestones on the west side of Pogonip Mountain, White Pine District, Nevada. In the Eureka District it is found in the upper beds of the Secret Cañon shale, opposite the dump of the Richmond mine shaft, Ruby Hill, northeast side of the cañon, and in the Hamburg belt of shale east of the Hamburg mine, Eureka District, Nevada.

Genus ANOMOCARE Angelin.

Anomocare ? parvum, n. sp.

Plate ix, fig. 17.

Glabella and fixed cheeks united, subquadrangular in form, moderately convex. Glabella tapering gradually from the base to the front, where it is rounded truncate; the surface is depressed convex and marked by four pairs of glabellar furrows, which are short, slightly impressed, and divide the glabella into three subequal lobes, with a somewhat longer anterior lobe; occipital ring strong, swollen towards the center, and bearing a short spine; occipital furrow well defined; dorsal furrows blended with the depressed interior slope of the fixed cheeks and frontal lobe; this causes the glabella to stand out prominently, although but little elevated above the general surface of the head; fixed cheeks rather broad, with a rounded, ridge-like elevation near the eyelobes, and sloping inward to form a depressed space before reaching the glabella; eyelobes large, with an ocular ridge running towards the anterior lobe of the glabella; frontal lobe short and convex, merging into the fixed cheeks laterally, and in front into the strong furrow within the broad, marginal border; the border is convex and swollen at the center into a small protuberance; postero-lateral limbs narrow and rather depressed.

Surface finely granulose.

The identification of the genus Anomocare is made with the illustrations given by Angelin, and, until we know more of the structure of the species under consideration, it is difficult to give any other generic reference. No pygidiæ or remains of the thoracic segments were found in the same association.

Formation and locality.—Cambrian. In a limestone beneath the arenaceous shales carrying the species of Olenellus, given on a previous page, and associated with *O. Gilberti* and *O. Howelli.* West slope of Prospect Mountain, Eureka District, Nevada.

Genus PTYCHASPIS Hall.

Ptychaspis minuta Whitfield (?).

Plate x, fig. 23.

Ptychaspis minuta Whitfield, 1878. Ann. Rep. Wisconsin Geol. Surv., p. 55. *Ibid.*, Geol. Wisconsin, vol. iv, p. 186, pl. i, figs. 25, 26, 1883.

This is a very minute form, the head measuring only about 3^{mm} in length. A comparison of the glabella and fixed cheeks, the only parts thus far discovered, with the description of the original type specimens from the Potsdam sandstone of Wisconsin, shows such close resemblances between the two that with our present knowledge it appears impossible to consider them as specifically distinct. The frontal limb scarcely projects beyond the front line of the glabella, as it slopes abruptly downward, although it is represented as projecting out some distance in the specimen illustrated owing to a narrow seam of calcite crossing it and throwing it forward.

Formation and locality.—Cambrian. Prospect Mountain Group, eastern base of Lookout Mountain, Sierra Valley, Eureka District, Nevada.

Genus CHARIOCEPHALUS Hall.

Chariocephalus (?) tumifrons H. & W.

Plate x, fig. 16.

Chariocephalus tumifrons Hall & Whitfield, 1877. Geol. Expl. Fortieth Par., vol. iv, p. 224, pl. ii, figs. 38, 39.

The types of this species came from the lower limestones of Pogonip Mountain, in the White Pine District, Nevada.

The specimen illustrated as the type of the species is the extreme form attained by the adult. Traced in a series of individuals, towards the younger form, the anterior lobe of the glabella is seen to lose its tumid, projecting character, and to curve down to the frontal margin and not overhang it, as in the older individuals. One of the intermediate phases of growth is shown by fig. 16, plate x.

Formation and locality.—Cambrian. In the upper beds of the Secret Cañon shale on the north side of the cañon, opposite the dump of the shaft of the Richmond mine on Ruby Hill, Eureka District, Nevada.

Genus AGRAULOS Corda.

Agraulos ? globosus, n. sp.

Plate ix, fig. 23.

Glabella and fixed cheeks, exclusive of the postero-lateral limbs, subquadrate, strongly convex. Glabella with the sides and front rounded, convex, and with the surface apparently smooth; dorsal furrows well defined; occipital ring not perceptibly separated from the glabella; fixed cheeks of medium width; palpebral lobes small, the cheeks sloping down to them; frontal limb about one-third as long as the glabella, convex, without an apparent marginal rim, and with a slight furrow at the union with the fixed cheeks; postero-lateral limbs strong, extended laterally and with a distinct marginal furrow, which is usually the continuation of the occipital furrow. Facial suture directed gently forward from the eyelobe towards the front, recurving to the frontal margin of the head so as to round the lateral angles of the frontal limb; behind the eye it passes to the posterior margin at an angle of 20°–25° with the latter, outlining a triangular-shaped lateral limb.

This peculiar little species (the head is but 3^{mm} in length) appears to unite some embryonic features with those of the adult individual. It is doubtfully referred to Agraulos. The discovery of allied species or more specimens of this one may enable the observer to determine more fully its true generic relations.

Formation and locality.—Cambrian. In a small outcrop of limestone on the west side of the Eureka District, Nevada.

Genus ARETHUSINA Barrande.

Arethusina Americana, n. sp.

Plate ix, fig. 27.

Glabella and fixed cheeks united, a little wider than long, the front broadly rounded, and the sides a little contracted midway. Glabella prominent, conical, convex, rounded in front, and marked by two pairs of short furrows extending obliquely inward less than one-fourth the distance across; occipital ring narrow, defined by a shallow occipital furrow; fixed cheeks broad, sloping away from the well-defined dorsal furrows to the minute palpebral lobes; well-marked ocular ridges cross from opposite the anterior portion of the glabella to the eyelobes; all in front of these is occupied by the broad, expanded frontal limb; it is slightly convex to the anterior narrow marginal rim; postero-lateral limbs but little extended laterally and with a marginal groove within the posterior border. Facial suture extends a little outward in a gentle curve to the frontal margin from the eyelobe, recurving just before reaching the margin; behind the eyelobe it is directed obliquely backward, outlining a triangular lateral limb and cutting the posterior margin at a distance from the dorsal furrow equal to the width of the glabella at its base.

Surface of the glabella minutely granulose; the frontal limb has a peculiar ornamentation formed by irregular inosculating lines that in their general direction radiate towards the anterior rim.

With the portions of this species we have before us, it appears to be related to Arethusina more closely than any other described genus. The posterior glabellar furrows are less oblique than in the Bohemian species, but otherwise there is a strong generic resemblance between them.

Formation and localities.—Upper beds of the Cambrian. On the ridge north of the Dunderberg mine, at about the same horizon on the north side of the cañon north of Adams Hill, and also in the Pogonip Group, on the second ridge southeast of the Jackson mine, Eureka District, Nevada.

Genus OGYGIA Brongniart.

Ogygia ? spinosa, n. sp.

Plate ix, fig. 22.

Glabella elongate, not quite twice as long as wide; sides parallel nearly to the front, which is slightly expanded and broadly rounded anteriorly; moderately convex and subangular along the median line; marked by three pairs of oblique furrows that extend one-third the distance across; occipital ring strong, not very convex, and with a rather strong central spine projecting backward and upward; occipital furrow shallow, well defined; fixed cheeks narrow; palpebral lobes large, rising slightly from the dorsal furrows to the depressed furrow just within and parallel to their margins; frontal limb convex, of medium width and length, and bordered by a flattened rim. The presence of the strong occipital spine is one of the most distinct characters of this species.

Formation and locality.—Cambrian. Prospect Mountain Group; at the base of the Secret Cañon shale in Secret Cañon, Eureka District, Nevada.

Ogygia ? problematica, n. sp.

Plate x, figs. 2*a–b*, and 4.

Glabella elongate, clavate, expanding regularly from the base to a width one-third greater in front; moderately convex behind, becoming almost tumid on the frontal lobe, and in compressed examples slightly projecting over the anterior margin; marked by three pairs of oblique, slightly impressed furrows; these are united across the center by short transverse depressions; occipital furrow shallow; occipital ring strong, flattened; fixed cheeks of medium width, separated from the glabella by distinct but lightly impressed dorsal furrows, and sloping outward to the medium-sized eyelobes; postero-lateral limbs strong and well extended laterally; frontal limb as a narrow margin close to the front of the glabella.

The facial sutures have the general course of those in the genera Ogygia and Asaphus.

The above description is drawn from a well-preserved adult specimen of the head, that, excepting the free cheeks, is 23^{mm} in length. In a young example of the same parts, 7^{mm} in length, the glabella is less convex, subangular in front, sloping to the margin, and the glabellar furrows are obsolete; in other respects it strongly resembles the adult.

With these parts before us we would refer the species to Ogygia; but in every instance where they have been found there are pygidiæ, thoracic segments and fragments associated with them that indicate an entirely different genus. An illustration is given of the pygidium on plate x, fig. 2*a*, and of the segment, fig. 2*b*. They occur in association along an outcrop of several miles, and no other species of a similar size is known to exist at the same horizon. No genus known to us combines the characters presented by the head and pygidium, and, although they have not been seen united to the thorax, the evidence is in favor of their belonging to the same species.

A provisional reference is made to Ogygia, the genus to which the head appears to belong, the pygidium and thoracic segments having more the character of those referred to Dicellocephalus.

Formation and localities.—Cambrian. Prospect Mountain Group, upper beds of the Secret Cañon shale, on the east side of Secret and New York Cañons, and on the south slope of Adams Hill, Eureka District, Nevada.

FOSSILS OF THE LOWER SILURIAN.

POGONIP GROUP.

RHIZOPODA.

Genus RECEPTACULITES Defrance.

Receptaculites mammillaris Newberry.

Plate xi, fig. 11.

Receptaculites mammillaris Newberry, 1880. Name proposed in manuscript.

There is quite a range in the forms taken by this species, the most prevalent of which is an inverted cone with a deep depression on the upper surface, the height being to the diameter of the summit as four to five. In the more expanded examples, with the height and diameter as one to two, the base is small, and when the specimens are reversed, form a nipple-like projection on the summit of the broadly rounded surface. The walls have a thickness of about 18^{mm}, in examples from 40^{mm} to 50^{mm} in diameter.

The outer surface or ectorhin is formed of rhomboidal plates arranged in radiatingly curved lines crossing each other obliquely; the plates near the base have a greater diagonal axis of 1^{mm}, which gradually increases to 2.5^{mm} in the plates towards the summit; the only surface character preserved is a slight depression in the center of each plate. The cylindrical tubes uniting the ectorhin and endorhin have the characteristic construction of such tubes in Receptaculites near the base, but have not the connecting stolons or tubes between the constrictions and the ectorhin. Their absence may be owing to the imperfect condition of the specimens examined. Along the upper portion of the tubes there is a series of annulations, ten in a distance of 6^{mm}, that appear to be made up of little projections or stolons uniting the tubes on the upper annulations.

In the mode of growth and general form this species is related to *R. Neptuni*, but differs in the details of structure.

Several years since Dr. J. S. Newberry obtained examples of the species from the White Pine Mining District, and also from Pioche, Nevada, proposing the specific name *R. mammilaris*, in his notes, on account of the appearance of the more expanded forms with the nipple-like base. An illustration is given of the most abundant form in the Eureka District. The complete illustration of this and its associated species of the genus is deferred until sections can be prepared to exhibit the details of structure.

Formation and localities.—Upper portion of the Pogonip Group at Lone Mountain, 18 miles northwest of Eureka; White Mountain, Fish Creek Mountains, and Goodwin Cañon in the Eureka District; and also at Pioche and Treasure City, White Pine Mining District, Nevada.

Receptaculites elongatus, n. sp.

The general form of this species is cylindro-conical, with the central depression extending deep down into the body, the thickness of the sides near the base and at the summit being nearly the same. The outline of the central depression is circular, and there is no evidence of the growth of the sides over it as in some species of the genus from Canada and Wisconsin, *e. g.*, *R. Jonesi*, *R. fungosum*, etc. The ectorhin is formed of small rhomboidal plates, arranged as in other forms of the genus; the largest plates have a greater diagonal diameter of about 1^{mm}, and a lesser one of about five-sixths of 1^{mm}. The cylindrical tubes uniting the ectorhin and endorhin are small, constricted at the base, and apparently smooth up to their union with the plates of the endorhin. The sides of a specimen 45^{mm} high, and with a transverse diameter of 20^{mm}, have a thickness of 7^{mm} above and of 5^{mm} near the base

This species is distinguished from any known to me by its cylindro-conical form, deep central cavity, and small cells or tubes. It approaches *R. insularis* Billings, of the Middle Silurian of the island of Anticosti (Cat. Sil. Foss. Anticosti, p. 29, 1866), but differs in having the deep central depression and a less rapidly tapering form; these features, united with the fact of the great vertical difference in the geologic horizon at which the two forms occur, render the probability of a specific identity very doubtful.

Formation and localities.—Upper portion of the Pogonip Group, White Mountain and Goodwin Cañon, Eureka District, Nevada. Also in the collection of the School of Mines, Columbia College, New York, collected by Dr. J. S. Newberry in the Pahranagat Range, Nevada.

Receptaculites ellipticus, n. sp.

Plate xi, fig. 12.

This is an elongate, flattened, curved form, with a strongly elliptical transverse section, the curvature being with the major diameter of the section. The central depression is deep, but not as large proportionally as in *R. elongatus.* The plates of the ectorhin are of medium size, 1.75^{mm} by 1.25^{mm}, and arranged as in the preceding species. The cylindrical tubes uniting the ectorhin and endorhin are strong and appear to be round and smooth, except where marked by the constriction and connecting basal stolons. The plates of the endorhin are concealed by the adhering matrix in all the examples in the collection.

The illustration shows the curvature and general form of a well-marked example of the species. It is specifically distinct from any described form that we know of, although allied to *Receptaculites infundibulus* Hall (Rep. Geol. Surv. Wisconsin, 8vo, pam., p. 16, 1861) = *Ischadites tessellatus* Winchell and Marcy, of the Niagara Group of Illinois (Mem. Bos. Soc. Nat. Hist., vol. i, p. 85, pl. ii, fig. 3, 1865), from which it differs in the size of the ectorhinal plates and other details of structure.

Formation and localities.—Upper portion of the Pogonip Group, White Mountain, Goodwin Cañon, and Fish Creek Mountains, Eureka District, Nevada.

BRACHIOPODA.

Genus OBOLELLA Billings.

Obolella ? ambigua, n. sp.

Plate i, fig. 2 *a*, *b*, *c*.

Shell of medium size for the genus as now known, ovate, moderately convex; surface lamellose; shell calcareous. Ventral valve ovate, broadly rounded in front, widest one-third the length from the front, thence rounding and narrowing gently to the beak, which is rather broadly rounded; area unknown. The dorsal valve is transversely ovate to subcircular, beak emarginate.

The interior of the ventral valve is unknown; that of the dorsal valve shows a central median depression divided centrally by a narrow raised line; towards the beak the depression is broader, narrowing midway, and dividing before reaching the center of the shell; a large muscular scar occurs each side of the central depression, and also a depressed line a little beyond them that runs out obliquely from the beak. There appears to be a muscular scar on each side of the center of the median depression just at its bifurcation. No other scars could be detected.

In external form and character this species is allied to *Obolella gemma*, and *O. chromatica* of Billings. The arrangement of the muscular scars in the smaller valve is peculiar and the shell is also thinner than in the above species.

The generic reference is made with a query as in comparing it with the dorsal valve of *Obolella sagittalis* Salter, as illustrated by Davidson, we find a marked difference and would scarcely refer the two to the same genus. In a comparison with American species the reference would be to Obolella, as the interior of the dorsal valve has not been given in the typical species, and that of *Obolella polita* has little if any more than a strong specific variation from that of *O. ? ambigua.*

Mr. Davidson, in speaking of the species arranged under Obolella, says that the diagnosis of the genus will require modification before it can comprise *O. chromatica* (the type) *O. ? polita, O. ? Salteri, O. desiderata,* etc. From our limited study and comparisons it does not appear that all these can be united under one genus—*O. polita* and *O. ambigua* presenting one type, *O. gemma* and *O. desquamata* another, and *O. sagittalis* Salter, still another among the species now referred to the genus.

Formation and locality.—Pogonip Group. Base of Silurian. East slope of ridge east of the Hamburg mine, Eureka District, Nevada.

Genus SCHIZAMBON, n. g.

Shell ovate or oblong oval, inequivalve; valves inarticulate; larger or ventral valve most convex, with a short obtuse beak at the cardinal margin. Foramen oblong and opening on the summit of the valve, no area nor deltidium; cardinal edge thin; smaller or dorsal valve nearly as convex as the larger, slightly flattened along the median line.

Structure calcareo-corneous, consisting of a nacreous outer layer with a closely attached inner calcareous layer. Both layers are thought to be punctured by scattered tubulæ. Surface smooth or with distinct lines of growth and scattered spines apparently on the outer edges of the laminæ or lines of growth.

The interior of the larger valve shows the oblong foramen in a slight elongate depression and a pair of muscular scars just in front of it on each side of a slight longitudinal depression; from near the beak on each side of the foramen, a shallow sharply defined depression extends obliquely outward. No other markings were observed. In the interior of the dorsal valve a pair of anterior central muscular scars terminate their path of advance from the beak, a slight rounded ridge rising on the central line; posterior to these a larger pair occur, and still beyond and more posterior a third pair, a narrow rounded ridge extending obliquely down from the beak on each side between the central and lateral scars.

The above description is based on a large number of specimens. Numerous interiors of the valves occur owing to the rough outer surface clinging to the fine arenaceous limestone matrix. In the interiors little pits occur scattered irregularly over the surface, and on the outside similar pits are seen. It is difficult to determine whether these communicate with each other. Judging from their appearance and also from a cross-section of the shell that shows minute tubulæ nearly through the shell, we are inclined to consider the shell as punctate. The little, short spines of the outer surface have the form of those on Siphonotreta; whether they are hollow or not has not been determined.

The most nearly related genera are Acrothele and Acrotreta. It is unlike Acrothele in the structure of its shell, in the position of the opening on its ventral valve with relation to the apex of the valve and in the absence of any indication of a false area. The general facies of the shell also suggests another generic group. Its affinity with Acrotreta consists in the presence of the three pairs of muscular scars in the smaller valves and in the perforate larger valve. The surface structure and general form closely ally it to Siphonotreta, and I would refer *Siphonotreta fissa* Kutorga, to this genus, as in all external characters it is almost specifically related to *Schizambon typicalis.*

Schizambon typicalis, n. sp.

Plate i, figs. 3*a–d.*

Shell small, longitudinally ovate; length and breadth nearly the same; front and side margins broadly rounded; posterior margin of the ventral valve slightly acuminate, of the dorsal valve broadly rounded, except a very slight projection at the center. The ventral valve has a small, oblong foramen near the apex, with a gradually narrowing depression extending to the posterior extremity. Both valves are slightly convex, the ventral one the more so. Surface marked by lamellose concentric raised lines, bordered with fine spines on the outer portions of the shell. Towards the beak numerous fine concentric striæ appear.

The shells consist of an outer nacreous layer, with an exceedingly thin inner calcareous layer closely attached to it. As has been mentioned under the generic description, the shell appears to be punctate. In many instances scarcely a pit is seen on the inside of the shell, while in others they are scattered quite thickly over the surface. The largest specimens obtained measured 5^{mm} in length by 4.5^{mm} in breadth.

In the ventral valve, fig. 3, the margin of the siphonal opening is slightly elevated and extends quite to the beak, leaving a triangular, elongate, narrow depression behind the opening. Starting near the beak and running obliquely outward a slightly-depressed, narrow, smooth line shows the advance of a muscular scar; between this and the siphonal opening a smooth space intervenes, in the front of which a pair of muscular scars can be detected. A slight depression extends forward in advance of the siphonal opening.

The dorsal valve, fig. 3*b*, shows a narrow median ridge with a pair of minute, elongate, oval scars at its front termination (*a*, *a*); posterior to these and between the central ridge and a low ridge extending from the beak obliquely outward and forward a larger, reniform scar occurs on each side (*p*, *a*); outside of the narrow lateral ridges and on the posterior lateral portion of the shell another minute scar is seen on each side (*a*, *d*). None of the specimens show a scar beneath the beak.

A comparison with the figures of *Siphonotreta fissa* Kutorga[6] shows a strong generic relation, judging from the external characters; specifically they have several points in common.

The species occurs in the passage beds at the base of the Pogonip Group in the same band of layers carrying *Acrotreta gemma*, Lingulepis, Discina, Orthis, *Camarella calcifera*, *Ptychoparia Oweni*, *Dicellocephalus finalis*, *Illœnurus Eurekensis*, Amphion, *Barrandia McCoyi*, etc.

Formation and locality.—Lower portion of Pogonip Group. East slope of ridge east of the Hamburg mine Cañon, Eureka District, Nevada.

Genus STROPHOMENA Rafinesque.

Strophomena Nemea, H. & W.

Strophomena Nemea, Hall & Whitfield, 1877. Geol. Expl. Fortieth Par., vol. iv, p. 233, pl. i, fig. 15.

This species occurs in the upper beds of the Pogonip Group at Lone Mountain, 18 miles northwest of Eureka, at the same horizon on McCoy's Ridge, and a little lower down in the strata on the west slope of Secret Cañon road Cañon, Eureka District, Nevada.

The original type of the species is from Pogonip Mountain, White Pine District, Nevada.

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[6] Über die Brachiopoden-Familie der Siphonotretææ. Verhandl. der Russ. Kais. Mineral. Gesellschaft, 1848, p. 250, pl. vii, figs. 5*a*–*c*.

Genus ORTHIS Dalman.

Orthis perveta Conrad.

Plate xi, figs. 3, 3*a*, *b*.

Orthis perveta Conrad, 1843. Proc. Acad. Nat. Sci. Phila., vol. i, p. 333.
Hall, 1852. Pal. New York, vol. i, p. 120, pl. xxxii, figs. 5*a–c*. *Ibid.* Geology of Wisconsin, p. 42, figs. 7*a–d*, 1862.
Billings, 1863. Geol. Canada, p. 130, figs. 57 *a–f*.

This species is quite abundant in the upper beds of the Pogonip Group at Lone Mountain, and it also ranges through nearly 1,000 feet of the limestone of White Mountain, and is found at about the same horizon on the eastern slope of the ridge east of the Hamburg mine, as in the lower beds of White Mountain.

A direct comparison of the Nevada specimens with the types of the species in the American Museum collections show their specific identity, and also that similar variations occur in examples from the widely-separated localities. In Wisconsin it is found in the Trenton limestone, and in Canada Mr. Billings identified it from the Chazy limestone.

A small but quite perfect specimen is illustrated. Owing to the partial exfoliation of the shell, the radiating striæ are not as strong as on the uninjured surface.

In the expedition of 1882 this species was found in the upper part of the Pogonip Group, on Pogonip Ridge, White Pine District, Nevada.

Orthis testudinaria, Dalman.

Plate xi, figs. 10, 10*a*.

Orthis testudinaria Dalman, 1827. Vet. Acad. Hand., Stockholm, p. 115.
Orthis testudinaria Conrad, 1839. Emmons, 1842; Hall, 1852. Pal. N. Y., vol. i, p. 117, pl. 32, figs. 1 *a–l*. Whitfield, Geol. of Wisconsin, vol. iv, p. 258, pl. xii, figs. 5, 7, 1883.
See Davidson's Monograph British Silurian Brachiopoda.

After comparing our specimens with those from New York, Ohio, and Wisconsin, we are unable to discover any differences of specific value between them, although the eastern forms are from the Trenton Group=Trenton limestone and Hudson River formations, and the Eureka specimens from the horizon of the Chazy limestone and Calciferous sand-rock of the New York series. This identification and reference gives a greater vertical and geographic range to a species already distinguished for its wide distribution. In England it ranges from the Llandeilo into the Lower Llandovery, and it is also known in Ireland, Scotland, and Sweden.

Formation and localities.—Pogonip Group, summit of White Mountain, and about 1,000 feet below that horizon on east slope of ridge east of the Hamburg mine, Eureka District, Nevada, and at the same horizon on the north end of Pogonip Ridge, White Pine District, Nevada.

Orthis Hamburgensis, n. sp.

Plate xi, figs. 5, 5*a*.

Shell small, suborbicular in outline, plano-convex; hinge line a little shorter than the greatest breadth of the valves. Dorsal valve moderately convex, most elevated a little behind the center, along a slight ridge formed by two or three strong, slightly-raised striæ; beak small, depressed about half-way down to the cardinal margin. Ventral valve depressed, slightly convex, mesial depression well defined from the beak to the front margin.

Surface of both valves marked by from 12 to 18 strong angular striæ, which increase by bifurcation or intercalation towards the margin.

This species is represented by many separate valves, but none show the area of either valve. It is allied to *O. testudinaria*, but differs essentially in the surface ornamentation, which is more like that of *O. plicatella* in the fissicostate character of the striæ. A comparison with the adult shells of *O. plicatella* and *O. fissicosta* shows that their surface characters are strongly developed in *O. Hamburgensis*, while in the young shells of the same species of the size of the latter these features are not present.

Formation and localities.—Central part of Pogonip Group, on the east slope of the ridge east of the Hamburg ridge; on the east slope of the second ridge southeast of the Jackson mine, and also on the second ridge east of Secret Cañon, Eureka District, Nevada.

Orthis Lonensis, n. sp.

Plate xi, figs. 6, 6 *a*.

Shell of medium size, transversely semi-oval, width and length as 4 to 3; hinge line about equal to the greatest breadth of the valves.

Ventral valve elevated, convex; the greatest convexity a little behind the middle on each side of a shallow, broad mesial sinus; beak small, not projecting backward; area high at the beak, sloping rapidly to the lateral margins; slightly arched, and standing at nearly right angles to the plane of the valve; foramen a little higher than broad, with its apex extending to the termination of the beak. Dorsal valve unknown.

Surface ornamented by distinct radiating striæ that increase by intercalation, and curve gradually outward to the postero-lateral margins.

This species belongs to that group of Orthis, of which *O. occidentalis* is a type, and appears to be specifically distinct from any described species.

Formation and locality.—Pogonip Group, upper beds, Lone Mountain, 18 miles northwest of Eureka, Nevada.

Orthis tricenaria, Conrad.

Plate xi, figs. 4, 4 *a*.

Orthis tricenaria Conrad, 1843. Proc. Acad. Nat. Sci., vol. i, p. 333.
Orthis tricenaria Hall, 1852. Pal. N. Y., vol. i, p. 121, pl. xxxi, figs. 8 *a*, *c*. *Ibid.*, Geol. Surv. Wisconsin, vol. i, p. 42, figs. 8–11, 1862.
Orthis tricenaria Billings, 1863. Geol. Canada, p. 167, figs. 151 *a*, *b*.

An examination of a good series of specimens of this species shows that it varies a little in the number and strength of the surface striæ in both the young and old shells, the variation extending from the average number of 28 to 30, to 16 as the minimum and 35 as the maximum; with this in view, the specimens from the Pogonip Group (upper beds, at Lone Mountain and Surprise Peak) cannot well be specifically separated from those of Wisconsin and New York. The general form of the shell is the same, and the number of radii varies from 16 to 30. Some of the examples are almost typical forms of *Orthis costalis*, of the Chazy limestone of New York, and a comparison of specimens shows the two species to be closely allied. It may be considered that the Nevada form is a variety of *O. tricenaria*, and worthy of a distinct name, but until there is more evidence than at present, we prefer to recognize it as coming within the limits of the eastern species.

Formation and locality.—Pogonip Group at Lone Mountain, 18 miles northwest of Eureka, and on Surprise Peak, Eureka District, Nevada. It also occurs at the same horizon on Pogonip Ridge, White Pine District, Nevada.

Genus STREPTORHYNCHUS King.

Streptorhynchus minor, n. sp.

Plate xi, fig. 9.

Shell small, transverse, semi-oval; hinge line fully equaling the greatest breadth; lateral extremities nearly rectangular.

Ventral valve moderately convex along each side of a rather broad mesial depression, extending from the umbo to the front margin; postero-lateral regions flattened within the margin; beak minute and scarcely to be distinguished from the cardinal margin. Dorsal valve unknown.

Surface of ventral valve ornamented with rather fine radiating striæ that increase by intercalation towards the front margin.

Length of specimen, 6^{mm}; breadth, 11^{mm}; convexity, about 1.25^{mm}.

This little shell presents the characters of a resupinate Strophomena, and is therefore placed under the genus Streptorhynchus. It may be compared with young shells of *Streptorhynchus sinuatus* Emmons (Pal. Ohio, vol. 1, p. 87, pl. v, figs. 5 *a–f*, 1873), but it appears to be a distinct species from any described.

Formation and locality.—Pogonip Group, upper beds, at Lone Mountain, 18 miles northwest of Eureka, Nevada.

Genus TRIPLESIA Hall.

Triplesia calcifera Billings.

Plate xi, figs. 7, 8.

Camerella calcifera Billings, 1861. Canadian Nat. and Geol., vol. vi, p. 318, figs. 3 *a–c*. Geol. Canada, p. 231, figs. 247 *a–c*, 1863. Pal. Foss., vol. i, p. 220, 1865.

There is considerable variation among the specimens referred to this species in the collection, and two species appear to be indicated. In one the mesial depression is shallow with broadly-rounded sides, and in the other it is deeper and more angular. In the dorsal valves the variation is quite as great, but with more gradations between the valves with a scarcely perceptible median fold and those where the fold is the prominent feature.

The figure of the ventral valve, fig. 7, is of the type of that given by the author of the species, and that of the dorsal valve, fig. 8, is not very dissimilar, although representing what may prove to be a distinct species.

Formation and localities.—Lower portion of the Pogonip Group, and upward about 1,000 feet on the east slope of ridge east of the Hamburg mine; on the second ridge southeast of the Jackson mine, also northeast of Adams Hill; on the ridge southeast from the Wood Cone; at the southwest end of McCoy's Ridge, and on the west side of Goodwin Cañon, Eureka District, Nevada.

LAMELLIBRANCHIATA.

Genus TELLINOMYA Hall.

Tellinomya contracta Salter (?)

Plate xi, fig. 15, 15 *a*.

Ctenodonta contracta Salter, 1859. Canadian Organic Remains, Dec., i, p. 37, pl. viii, figs. 4, 5.

It is not improbable that the Nevada shell is specifically unlike *T. contracta*, but with the specimens at hand it is difficult to determine the differences if they exist. Mr. Billings has described a closely allied form from the Quebec series of Newfoundland, but our species is more nearly related to Salter's species from the Trenton limestone of Canada, to which, for the present, it is referred.

Formation and locality.—Upper part of Pogonip Group, Fish Creek Mountains, Eureka District, Nevada. It also occurs at the same horizon on Pogonip Ridge, White Pine District, Nevada.

Tellinomya ? Hamburgensis n. sp.

Plate xi, figs. 1, 1 *a*.

Shell small, thin, convex; rounded subrhomboidal in outline with the height and width subequal; beak elevated, incurved, and raised above the hinge line anterior to the center of the shell.

The surface presents a smooth, glistening appearance, and is marked by fine concentric striæ and very fine, often scarcely perceptible radiating striæ. This surface gives to fragments of the shell the character of some of the Linguloid shells.

The species belongs, by its general form, to the group of which *T.* (*Ctenodonta*) *varicosa* Salter (Mem. Geol. Surv. Gt. Brit., vol. iii, p. 345) and *T.* (*C.*) *astartæformis* Salter (Can. Org. Remains, dec. 1, p. 39, pl. viii, fig. 7) are the types; specifically it is distinct.

Formation and locality.—Upper part of Pogonip Group. East slope of ridge east of the Hamburg Ridge, Eureka District, Nevada.

Genus MODIOLOPSIS Hall.

Modiolopsis occidens, n. sp.

Plate i, fig. 5; pl. xi, figs. 14, 14*a*.

Shell small, elongate, ovate in outline; broadest at the posterior half, contracting to about two-thirds the greatest width at the beaks; hinge-line nearly straight and a little more than half as long as the shell posterior to the beaks; posterior margin slightly convex and sloping obliquely from the extremity of the hinge-line to the rounded posterior end of the shell; the basal line curves downward, and then with a slight sinuosity, opposite the beak, extends nearly straight to the somewhat narrow, sharply rounded, anterior end; beak small, scarcely extending above the hinge-line, and situated within the anterior third of the shell. The surface is moderately convex, most prominent along the posterior umbonal ridge, which is rather broadly rounded; umbonal slope abrupt and slightly convex. A broad, obscure mesial depression is shown on the lower part of the anterior half of the shell that does not extend up to the beak.

Anterior muscular scar of medium size and well defined; posterior scar, pallial line, and exterior surface markings unknown.

This species is related to *Modiolopsis mytiloides* Hall (Pal. N. Y., vol. i, p. 157, pl. xxxv, figs. 4 *a*, *b*) in its general outline, but differs in its less elongate form and in its position of its beaks.

Formation and localities.—Pogonip Group, upper portion, Fish Creek

Mountains, Eureka District, and beneath the white quartzite at Lone Mountain, 18 miles northwest of Eureka, Nevada. It also occurs at the same horizon on Pogonip Ridge, White Pine District, Nevada.

Modiolopsis Pogonipensis, n. sp.

Plate i, fig. 6; pl. xi, fig. 13.

Shell quite small, ovate in outline, broadest at the posterior third; hinge-line two-thirds the length of the shell posterior to the beak; posterior margin very oblique, slightly convex, and terminating at the somewhat sharply rounded posterior extremity of the shell; basal margin slightly curved, almost straight along the center; anterior end of the shell broadly rounded. General surface moderately convex, most prominent along the rounded posterior umbonal ridge; the beak is strong and rises a little above the hinge-line; anterior muscular scar distinct; posterior scar unknown.

Surface smooth or marked by broad inconspicuous lines of growth.

Formation and localities.—Same as preceding species.

GASTEROPODA.

Genus RAPHISTOMA Hall.

Raphistoma Nasoni Hall.

Plate xi, figs. 21, 21 *a*.

Pleurotomaria nasoni Hall (?) 1861. Rep. Prog. Geol. Surv. Wisconsin, pam., p. 34.
Raphistoma (*Pleurotomaria*) *nasoni* Hall, 1862. Geol. of Wisconsin, vol. i, p. 39, fig. 2.
Raphistoma Nasoni Whitfield, 1883. Geol. of Wisconsin, vol. iv, p. 215, pl. vi, figs. 2–3.

The Nevada shell is a closely allied or representative species of this, and in its condition as a cast it is impossible to give any good specific differences between them. It might be considered a distinct form from its occurring at so distant a locality and at a lower geologic horizon, but these circumstances are largely negatived by the facts that well-characterized Devonian species occur in New York and Nevada and at different relative horizons, as will be shown under the head of the Devonian fossils; and species heretofore considered as belonging to the Trenton horizon have been identified in the Pogonip limestone, e. g., *Orthis testudinaria, O. trice-*

naria, etc. Under such circumstances we prefer to refer all such species to described forms unless they show good, specific differences, or a difference in their geologic horizon that renders their occurrence extremely improbable.

Formation and locality.—About 1,000 feet down in the Pogonip Group, north slope of White Mountain, Eureka District, Nevada.

Genus MURCHISONIA D'Archiac and De Verneuil.

Murchisonia Milleri Hall?

Plate i, figs. 12, 12 *a*, *b*.

Murchisonia bicincta Hall, 1847. Pal. N. Y., vol. i, p. 177, pl. xxxviii, figs. 5, 5 *a–h*.
bicincta Salter, 1858. Canadian Organic Remains, dec. i, p. 19, pl. iv, figs. 5, 6, 7.
bicincta M. & W. ?, 1868. Geol. Surv. Illinois, vol. iii, p. 317, pl. iii, fig 4.
Milleri Hall, 1877. Cat. Amer. Pal. Fossils, Miller, p. 244.
Not *Murchisonia bicincta* McCoy, 1844. Syn. Sil. Foss. Ireland. p. 16.

On comparing specimens of *Murchisonia Milleri*, from Middleville, New York the typical locality of the species, with the Nevada shell, certain differences appear that would serve to separate the form from Nevada as a distinct species from *M. Milleri* if the range of variation in the specimens from the two localities did not afford examples from each that are specifically identical. As compared with the majority of the New York and Canadian specimens, the Nevada shell is more depressed, the aperture less elongate, and the carina above and below the peripheral carina less strongly marked, differences, however, that are not apparent when comparing with some shells from the typical locality at Middleville; with this in view, and the fact that a certain range of variation may be allowed for changes produced during the geographic distribution of the species, I think we are justified in identifying the Nevada shell with *M. Milleri.* It is associated with common Trenton limestone fossils, *Orthis tricenaria*, *O. perveta*, *Raphistoma Nasoni*, *Illœnus crassicauda*, and other species indicating the Trenton fauna.

Formation and locality.—Lower Silurian, near the summit of the Pogonip limestone of Pogonip Ridge, White Pine District, Nevada.

Casts of two species of Murchisonia occur in the upper beds of the Pogonip Group of the Eureka District. One is slender, elongate, and formed of many whorls, resembling the eastern species *Murchisonia gracilis* Hall (Pal. N. Y., vol. i, p. 181, pl. xxxix, figs. 4*a–c*); the other is a much larger, stronger species, more like *Murchisonia bellicincta* of the Trenton limestone of New York. The specific relations of either are not determined.

Genus PLEUROTOMARIA Defrance.

Pleurotomaria Lonensis, n. sp.

Plate xi, fig. 22.

Shell rather small, depressed conical; the apical angle about 110°; volutions three or four, each flattened above to within a short distance of the sharp mesial angle, where a narrow groove extends around on the lower volution, becoming obsolete on the second volution; suture in the cast strong and channeled; lower side of body volution sloping quite rapidly in from the mesial angle, a little concave just within the angle, and then gently convex to the umbilicus, which is rather small. Aperture rhombic-subquadrate, as far as can be determined from the form of the body volution.

Surface unknown except by the presence of rather strong revolving lines on the lower side of the body volution.

This species is distinct from any known to us.

At the same horizon and localities there is another species that may be referred to this genus; it is a larger and more robust form, having the whorls more convex above, flattened below on the body volution, and an acutely angular periphery at the union of the upper slope of the whorls and the base; this latter feature also occurs in *P. Lonensis*.

Formation and localities.—Upper beds of the Pogonip Group, Lone Mountain, 18 miles northwest of Eureka; at the south end of Fish Creek Mountain exposure of the Pogonip, and on east slope of ridge east of Hamburg mine, Eureka District, Nevada.

On the north end of Pogonip Ridge, White Pine District, Nevada, this species is abundant and reaches a larger size than at Lone Mountain.

Genus HELICOTOMA Salter.

Helicotoma sp.?

The specimens illustrating this species are badly crushed, but there is sufficient form preserved to show that it is allied to *H. planulata* Salter (Canadian Organic Remains, dec. i, p. 14, pl. ii, figs. 5–7) and *H. uniangulata* Hall (Pal. N. Y., vol. i, p. 179, pl. xxxviii, fig. 8). It is interesting from its occurrence at an horizon between those of the two species mentioned. The first being from the Calciferous sandstone of New York, and the second from the Trenton limestone of Canada.

Formation and localities.—Upper beds of Pogonip Group. Lone Mountain, 18 miles northwest of Eureka, and summit of White Mountain, Eureka District, Nevada.

Genus MACLUREA Le Sueur.

Maclurea annulata, n. sp.

Plate xi, figs. 19, 19 *a*.

Shell quite small, subdiscoidal, varying from 10^{mm} to 12^{mm} in the greatest diameter; spire depressed so as to form a false umbilicus; lower side flattened, the whorls all on one plane. Volutions about two, increasing rapidly in size with the increase in growth of the shell; flattened on the under side, rounded or subangular on the lower periphery; the sides rather steep; transverse section of the outer volution semiovate.

Surface of the shell somewhat strongly annulated, the annulations on the outer volution having a breadth of about 1.5^{mm}.

Casts of this species show the shell to have been quite thick, and a fragment of the outer volution is near 0.75^{mm} in thickness. The annulations and the constrictions between are strong, but owing to the thickness of the shell no perceptible traces of them are preserved on the internal cast.

The cast is more angular on the lower outer margin than on the upper margin; it bears a strong resemblance to *M. minima* H. and W. (Geol. Expl. Fortieth Par., vol iv, p. 235, pl. i, figs. 17–19), in this condition, but varies in the greater depth of the whorls and the more rapidly increasing size of the inner whorls of *M. minima*.

Formation and localities.—Strata of the Pogonip Group, north slope of White Mountain, 500 feet below the summit; east slope of ridge east of the Hamburg mine, Eureka District, Nevada. The species also occurs at the same horizon on Pogonip Ridge, White Pine District, Nevada.

Maclurea subannulata, n. sp.

Plate xi, figs. 18, 18 *a–b*.

Shell about twice the size of the preceding species and presenting all its essential features of a flat lower surface and deeply umbilicate or depressed upper side. It differs in the more rapidly increasing size of the volutions, their more elongate semioval section, more rounded periphery, and in the cast being obscurely annulated but in a reverse manner from what would be the case if the annulations of the outer shell of *M. annulata* were present on the cast; the constrictions, instead of being narrow, are quite broad and the annulations narrow.

Formation and locality.—Pogonip Group, north slope of White Mountain, Eureka District, Nevada.

Maclurea carinata, n. sp.

Plate xi, figs. 20, 20 *a*.

Shell small, general form thick, discoidal; greatest diameter, 20^{mm}; height of outer whorl, 6^{mm}; spire depressed to form a broad, shallow, umbilical-like area; lower side nearly flat, or with a slight umbilical depression of the inner whorl; volutions about three, increasing very regularly in size with the growth of the shell; slightly convex on the lower side, terminating in a decided carina on the periphery, where it unites with the slope of the side; the sides of the whorl are steep, and equal in depth to the width, the carina at the lower outer margin of the inner whorls resting in the sutures of the umbilical side.

Surface of the lower sides of the whorls marked by numerous strong striæ that arch across the whorl and forward over the carina; their course on the upper side has not been observed.

The cast of the outer whorl is round-oval in outline, the shell being thick and forming the carina seen on the outer surface. The presence of the basal carina distinguishes this species from any described form.

Formation and locality.—Upper beds of the Pogonip Group at Lone Mountain, 18 miles northwest of Eureka, Nevada.

Interior casts of a species allied to this, and it may be the same, occur on White Mountain and the lower eastern slope of the ridge east of the Hamburg mine, and at the same horizon on the Fish Creek mountains, Eureka District, Nevada.

Maclurea, sp. ?

Associated with the preceding at Lone Mountain there is a cast of a much larger and unusually flattened or compressed species. Owing to a doubt of this being its natural form, it was omitted in selecting specimens for illustration. In general form it is not unlike *M. acuminata* Billings (Pal. Foss., vol. i, p. 241, fig. 225, 1865), except that it is very shallow, not one-half the depth of the latter.

Genus METOPTOMA Phillips.

Metoptoma Phillipsi, n. sp.

Plate i, figs. 4, 4 *a*.

General form of shell depressed conical; outline of base broadly elliptical to ovate; apex elevated and situated a little behind the anterior margin; sides gently convex or sloping, almost straight from the apex to the lateral margins; anterior slope from the apex to the margin slightly concave; posterior slope, from the apex to the posterior margin, broadly convex.

Surface marked by fine concentric striæ of growth, with a few stronger striæ, or lines, at irregular intervals.

Dimensions: greater diameter of base of large specimen, 23^{mm}; lesser diameter, 17^{mm}; height of apex above base, 10^{mm}. A small specimen gives 8^{mm} and 6^{mm} for the two diameters of the base, and 3^{mm} as the height, showing that the relative proportions remain nearly the same in the young shells.

I know of no closely related American or European species. Mr. Billings has described a number of species from the Quebec and Trenton

Groups of Canada, but owing to the few salient characters to notice in a description, and the entire lack of illustration, it is impossible to make specific identifications. The most nearly related species with which I am acquainted are *Metoptoma Trentonensis* Billings (Pal. Foss., vol. i, p. 40, fig. 41, 1865), and *M. perovalis* Whitfield (Geol. Surv. Wis., vol. iv, p. 211, pl. v, figs. 13, 14, 1883), from the Trenton limestone.

Formation and locality.—Lower Silurian, near the summit of the Pogonip limestone, Pogonip Ridge, Eureka District, Nevada.

Metoptoma ? analoga, n. sp.

Plate i, figs. 11, 11 *a*.

Shell subconical, patelliform; outline of base broadly elliptical; apex elevated, subcentral, and bending slightly to one side.

Surface marked by slightly defined undulations of growth.

Dimensions.—Base, greater diameter, 11^{mm}; lesser diameter, 9^{mm}; height of apex above base, 6^{mm}.

This somewhat irregular shell occurs at the same geologic horizon as *M. Phillipsi*, but not in the same stratum of rock. It is a well-marked species, approaching the common form of a true patella more than the forms usually referred to Metoptoma. As with all generic references of the Paleozoic patelloid shells, when the interior muscular scars are unknown, it is more or less arbitrary.

Formation and locality.—Lower Silurian, near the summit of the Pogonip limestone, Pogonip Ridge, Eureka District, Nevada.

Genus CYRTOLITES Conrad.

Cyrtolites sinuatus H. & W.

Cyrtolites sinuatus Hall & Whitfield, 1877. Geol. Expl. Fortieth Par., vol. iv, p. 237, pl. i, figs. 23, 24.

The type of this species is from the Pogonip limestone of Pogonip Mountain, in the White Pine Mining District, Nevada. It also occurs in the upper beds of the same group at Lone Mountain, 18 miles northwest of Eureka, Nevada.

PTĒROPODA.

Genus COLEOPRION Sandberger.

Coleoprion minuta, n. sp.

Plate xi, figs. 17, 17 *a*; pl. xii, fig. 21.

Minute, slender, elongate subcylindrical tubes; slightly curved, with a distinct angularity on the outer side, section subelliptical. Average length, 8^{mm} to 10^{mm}; average diameter, 1.25^{mm} at smaller end to 2.25^{mm} at larger end.

Surface marked by fine annulations, with very fine concentric striæ between, the latter perceptible only under favorable conditions. The annulations are narrow, rather sharp, and cross the inner side of the curvature of the tube transversely, bending obliquely backward on each side, and meeting at an angle on the slight ridge on the outer side.

This interesting little species is probably a true Coleoprion, although presenting some differences from the typical species; these, however, appear to be rather of specific than generic value.

M. Barrande describes one species from the Upper Silurian (*Étage E*), and one from the Devonian, at which horizon all other species referred to the genus have been obtained. Its range is now extended down to the horizon of the Chazy limestone of the New York series, or the summit of the Pogonip Group of Nevada.

Formation and locality.—Upper Pogonip limestone of Lone Mountain, 18 miles northwest of Eureka, Nevada, and at the same horizon on Pogonip Ridge, White Pine District, Nevada.

Genus HYOLITHES Eichwald.

Hyolithes Vanuxemi, n. sp.

Plate xi, figs. 16, 16 *a*, *b*.

Form, a slender, elongate, subtriangular tube, with the lateral margins rounded, gradually tapering from the base to an acute extremity. Transverse section semi-elliptical, almost flat on the ventral side, the lateral edges rounded or subtriangular. Ventral face nearly flat transversely and incurved longitudinally; dorsal face strongly convex and obtusely angular along the center in some examples. Form of the aperture unknown.

Surface with fine transverse striæ on the ventral and dorsal sides along the central portion of the tube; these were not observed towards the aperture.

Length of larger examples, 20^{mm}; greatest width, 2.75^{mm}; depth, 2^{mm}.

This species is distinguished by its slender elongate form with the subtriangular section from any described form known to me.

Formation and locality.—Lower beds of the Pogonip Group, northeast of Adams Hill, Eureka District, Nevada.

CEPHALOPODA.

ORTHOCERATA.

Plate xii, figs. 1, 1 *a–c*, 2, and 3.

Numerous fragments of Orthoceratites occur in the upper beds of the Pogonip Group at Lone Mountain and the Fish Creek Mountains. From among them several well-defined species may be selected.

1. **Endoceras proteiforme** Hall ? (Pal. N. Y., vol. i, p. 208, 1847); plate xii, figs. 1, 1 *a–c*.

This is the most abundant, and is found at the principal exposures of the upper portion of the group, and the transverse sections (fig. 1 *a*) are often seen In fig. 1 the siphuncle with an inner tube is shown, and fig. 1 *c* shows the annulations on the outer surface of the siphuncle.

2. **Orthoceras multicameratum** Hall ? (Pal. N. Y., vol. i, p. 45, 1847); plate xii, fig. 3.

The fragment illustrated on plate xii, fig. 3, and also several not figured, shows a form closely allied to the species from the Birdseye limestone of New York; with the exception of the tube not converging as rapidly towards the apex the specific resemblance is very strong.

3. **Orthoceras** sp. ? plate xii, fig. 2.

An elongate form of the type of the preceding species. The material representing it is so fragmentary that a specific identification is not attempted.

4. Endoceras multitubulatum Hall? (Pal. N. Y., vol. i, p. 59, 1847).

Several elongate tubes filled in with smaller tubes, as in *E. multitubulatum*, occur in the upper beds of the Fish Creek Mountain Pogonip, and similar specimens were observed a little lower in the group at White Mountain. They belong to the same group of species as *E. multitubulatum*, but in the fragmentary condition of the specimens it is impossible to state that they are specifically identical with the Trenton species.

5. Orthoceras sp.? plate xii, fig. 1 *b*.

This is a transverse section of a tube showing a peculiar siphuncle and inner tube. As the figure on the plate does not give the desired representation, figures are here introduced that show a slightly oblique section at each end of a tube 10^{mm} in length.

The inner tube (*s*) is subcentral with a broad extension (*e*) from one side nearly to the side of the tube next outside of it (*x*), and on the opposite side a thin septum (*c*) projects towards the side of the tube. A longitudinal view of the tube (*s*) shows it to be straight and without annulations. Viewing the specimen as complete with the tubes (*s*) and (*x*), we find it to be closely allied to a section given of *Orthoceras bonum* by Barrande,[7] but if the outer shell (*o*) belongs to the Nevada shell and is not a fragment into which the tube (*x*) was drifted, then the peculiar section is not explained by any described species known to me, as it would be much as is represented by the fig. 1 *b* of plate xii, and be formed of three tubes, one within the other.

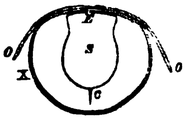

FIG. 1.

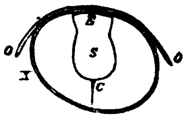

FIG. 2.

Future exploration and the discovery of more material will undoubtedly afford the paleontologist the means of identifying this and several other species now recognized by fragments too imperfect for description but still specifically distinct from each other and the species we have mentioned. The fragmentary remains now before us, however, with the associated Brachiopods, Lamellibranchs, and Gasteropods serve the present purpose of the geologist, as they indicate the passage from the Pogonip (Quebec) to the Trenton fauna.

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[7] Syst. Sil. Bohême, vol. ii, pl. ccxlvii, fig. 11.

CRUSTACEA.

Genus LEPERDITIA Roualt.

Leperditia bivia White.

Leperditia bivia White, 1874. Expl. and Surv. West 100th Merid. Prelim. Notice Invert. Foss., p. 11; *ibid.*, vol. iv, pt. 1, p. 58, pl. iii, figs. 7 *a–d*, 1875.

This species is very abundant in the upper beds of the Pogonip Group, at Lone Mountain, 18 miles northwest of Eureka, White Mountain, and the Fish Creek Mountains, Eureka District, Nevada.

The original type specimens were from the Schell Creek Range of Nevada.

Associated with this species we find two smaller species not unlike some varieties of *L. Canadensis* (Can. Organic Remains, dec. iii, p. 92, pl. xi, figs. 6, 7, 9, 10, 1858), the determination and illustration of which is left for future study.

Genus BEYRICHIA McCoy.

Beyrichia, sp.?

This is an interesting species, as it is of the type of *B. regularis* Emmons (Amer. Geol., pt. 2, p. 219, 1858), of the Hudson River Group of Ohio.

Owing to the imperfect condition of the specimens its further identification is delayed in the hope of obtaining better material. It is associated with *Leperditia bivia*, at White Mountain, Eureka District, Nevada.

Genus PLUMULITES Barrande.

The presence of this rare genus in American strata, west of Ohio, has not hitherto been recorded, and now we have but a single plate to show it. This is triangular in its general form, with the basal margin sigmoidal and the surface ornamented with the characteristic lines parallel to the sigmoidal margin. It occurs in the lower portion of the Pogonip Group, on the southwest end of McCoy's Ridge, Eureka District, Nevada.

PŒCILOPODA.

Genus DICELLOCEPHALUS Owen.

Dicellocephalus finalis, n. sp.

Plate xii, figs. 12, 12*a*, *b*.

Form of glabella and fixed cheeks united, very irregular; front broad, rapidly contracting before and expanding at the eyelobes to contract again back of them. Glabella of about the same width at the base and in front, expanding, on the posterior half, to the border of the palpebral lobes; general surface quite convex on the anterior half and moderately so farther back, marked by three pairs of glabellar furrows; the anterior pair slightly impressed and short, situated opposite the anterior end of the eyelobes; the median pair more strongly impressed and directed obliquely inward about one-fourth the distance across from side to side; directly back of this pair the margin curves outward around a curved expansion of the glabella, and within this the posterior pair of furrows are impressed, similar to the median pair, but not reaching the outer margin; this gives the posterior portion of the glabella a very peculiar aspect, unknown in any other species of the genus; occipital ring broad and flattened; occipital furrow narrow and well impressed; dorsal furrow distinct, but very shallow; fixed cheeks hardly more than a line, except where they join the broad frontal limb; palpebral lobes long and narrow; postero-lateral limbs narrow and extended laterally; frontal limb of moderate length, gently concave, and bordered by a strong rounded margin, the anterior edge of which is broadly rounded up to a very obtuse angle at the center.

Thorax known only by fragments of the segments associated with the head parts. These show the median lobe to have been moderately convex and the lateral lobes less so; the pleuræ are straight or slightly curved two-thirds the way out, and then curved backward on the free end; pleural groove strongly marked.

The associated pygidium is moderately convex, with a conical axial lobe crossed by three annulations, besides the long terminal one; lateral lobes indicating four coalesced segments, marked by pleural grooves and terminating in points that give a digitated margin to the pygidium.

Surface apparently smooth.

As all of these parts occur at one horizon and in the same layer, and no other large trilobite is associated with them, they undoubtedly belong to one species.

Formation and localities.—In the lower portion of the Pogonip Group, on the east slope of the ridge next east of the Hamburg Ridge, Eureka District, Nevada.

Dicellocephalus inexpectans, n. sp.

Plate i, fig. 10.

Glabella quadrangular, moderately convex, lateral margins parallel, broadly rounded in front; surface marked by two pairs of slightly impressed glabellar furrows directed obliquely inward and backward; the occipital ring is of medium width, and the occipital furrow distinctly but not deeply marked; dorsal furrows clearly defined at the sides and front of the glabella; fixed cheeks very narrow, sloping rapidly away before and behind the palpebral lobe; palpebral lobes prominent and of medium size; frontal limb rather long and well extended laterally; a number of raised lines radiate from the front of the glabella to the frontal margin; frontal margin narrow, rounded; postero-lateral limbs unknown. The facial sutures pass very obliqely inward from the anterior margin to the palpebral lobe, giving the front inclosed within them a campanulate form; curving around the palpebral lobes they pass outward on the postero-lateral limbs.

Surface finely granulose.

This species is associated in the same horizon with *D. finalis* of this report. It was collected one year after the latter was described in MSS. It affords another illustration of a Cambrian type continuing into the Silurian and mingling with its fauna.

Formation and localities.—Same as *D. finalis.*

Genus PTYCHOPARIA Corda.

Ptychoparia? anneotans, n. sp.

Plate xii, fig. 18.

Head very small, semicircular; postero-lateral angles unknown. Glabella moderately convex, length and width subequal, broadly rounded in front; marked by three pairs of furrows, the anterior pair scarcely perceptible, median and posterior pairs distinctly but not deeply impressed; occipital ring narrow, rounded, without a spine; occipital furrow well defined; dorsal furrow narrow, distinct, and extending with equal force in front of the glabella; fixed cheeks rather wide, sloping with a gentle convexity to the minute eyelobes and into the frontal limb; frontal limb convex, curving rapidly downward, and bordered by a rounded rim; postero-lateral limbs narrow, and extended quite a little distance laterally, marked by a narrow groove in the posterior margin.

Thorax and pygidium unknown.

This little species is closely allied to *P. minutus* (Sixteenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 150, pl. viii, figs. 5–7, 1861) of the Potsdam sandstone of New York, and the allied *P. minor* (*Ibid.*, p. 149), from the same horizon in Wisconsin. It differs in the shorter glabella, absence of nuchal spine, and larger frontal limb. It is interesting as occurring in association with the preceding species, and as terminating the upper limit of the range of the genus in the Prospect Mountain section.

Formation and locality.—In the lower portion of the Pogonip Group on the east slope of the ridge next east of the Hamburg Ridge, Eureka District, Nevada.

Genus BATHYURUS Billings.

Bathyurus? tuberculatus, n. sp.

Plate xii, fig. 9.

Glabella conical, strongly convex and elevated above the fixed cheeks; occipital segment narrow, elevated on the posterior margin, and with a short spine projecting backward and a little upward from the center; occipital furrow rather broad and strongly impressed; fixed cheeks of average width, sloping upward from the strongly marked dorsal furrows to the eyelobes, falling away to the front and back; frontal limb curving abruptly downward to a strong rounded rim-like margin; postero-lateral limbs strongly marked by a furrow within the posterior margin.

Surface of glabella and fixed cheeks ornamented with pustules, finely granulose in the narrow interspaces.

This species is characterized by the pustulose surface of the head. No remains of the thorax or pygidium were observed in association with the head parts.

Formation and locality.—Pogonip Group, on the ridge southwest of Wood Cone, Eureka District, Nevada, and at the same horizon on the north end of Pogonip Ridge, Eureka District, Nevada.

Bathyurus ? congeneris, n. sp.

Plate xii, fig. 8.

Compare *Bathyurus ? serratus* Meek, 1873. Sixth Ann. Rep. U. S. Geol. Surv. Territories for the year 1872, p. 480.

General outline of glabella and fixed cheeks, exclusive of the postero-lataerl limbs, subquadrangular and rather strongly convex. Glabella oblong, sides nearly parallel, and front rounded. Occipital ring of moderate width, and separated from the glabella by a narrow, well-impressed furrow; dorsal furrows narrow but well defined on the sides and in front of the glabella; fixed cheeks of medium width, somewhat depressed below the level of the glabella; frontal limb as a narrow, rounded rim; postero-lateral limbs extended laterally and with a narrow furrow within the posterior margin.

Surface finely granulose.

An illustration is given of the pygidium associated with the glabella and fixed cheeks, plate xii, fig. 8 *a*.

This species is closely allied to *Bathyurus ? serratus* Meek, and *Bathyurus oblongus* Billings (Pal. Foss., vol. i, p. 411, fig. 394, 1865), the chief difference between them being in the details of the frontal limb. They are congeneric, but whether belonging to this genus or not it is difficult to determine in the absence of the thorax and pygidium.

Formation and localities.—Pogonip Group, on spur southwest of Wood Cone and below Bellevue Peak, Fish Creek Mountains, Eureka District, Nevada.

Bathyurus ? simillimus, n. sp.

Plate xii, fig. 11.

This species is closely related to the preceding and to *B. oblongus* Billings, (*loc. cit.* p. 92) in the form and convexity of the glabella and fixed cheeks; the frontal limb, however, is longer, curved more abruptly downward, and bordered by a rounded rim that has a distinct, very obtuse angularity in front.

The surface of the glabella is minutely granulose.

Formation and locality.—In the limestone of the Pogonip Group, on the north slope of White Mountain, about 500 feet from the summit of the mountain, Eureka District, Nevada.

The pygidium, illustrated by fig. 14 of plate xii, is of the same type as that upon which Mr. Billings founded the species *Bathyurus caudatus* (Pal. Foss., vol. i., p. 261, fig. 245, 1865), which occurs in the Quebec Group of Newfoundland. It undoubtedly belongs to a distinct species; its generic relations are not recognized.

Genus CYPHASPIS Burmeister.

Cyphaspis ? brevimarginatus, n. sp.

Plate xii, fig. 10.

Glabella conical, strongly convex, marked by a pair of posterior glabellar furrows extending obliquely inward so as to nearly separate a small lobe at each postero-lateral angle; occipital segment broadest at the center narrowing towards the dorsal furrows; occipital furrow well defined; dorsal furrows distinctly impressed along the sides of the glabella; fixed cheeks rather narrow midway, widening in front; frontal limb as a scarcely perceptible, depressed, narrow rim in front of the glabella and fixed cheeks; postero-lateral limbs unknown.

Surface of glabella minutely granulose.

This species, although founded on a glabella but 4^{mm} in length, is clearly distinguished from any described form by its almost obsolete frontal margin and the conical outline of the glabella.

Formation and locality.—Pogonip Group, on the eastern slope of ridge east of the Hamburg Ridge, Eureka District, Nevada.

Genus AMPHION Pander.

Amphion Nevadensis, n. sp.

Plate xii, fig. 13.

Glabella subquadrangular, slightly convex, sides parallel, front broadly rounded; surface marked by three pairs of furrows, the two posterior pairs extending obliquely inward about one-third the entire distance across; anterior pair shorter and situated so far forward that the anterior lobe is somewhat irregularly rhomboidal in outline; occipital segment strong, flattened; occipital furrow narrow and like the dorsal furrows, deeply impressed; fixed cheeks known only in part; they are narrow in front, increasing in width at the eyelobes, and extending backward to the broad strong postero-lateral limbs; the latter are strongly marked by the continuation of the occipital groove within the posterior margin.

Surface granulose as far as can be determined from the specimens, which owing to exposure are somewhat imperfect.

Formation and localities.—Pogonip Group, upper portion, on the southeast slope of Bellevue Peak, Fish Creek Mountains, Eureka District, Nevada; *Amphion Nevadensis* also occurs in the Upper Pogonip limestone on the north end of Pogonip Ridge, White Pine District, Nevada.

Two pygidiæ occur at other localities, which may be referred to this genus. They belong to different species, but without the head parts a specific determination or name would be of little value.

Genus CERAURUS Green.

Ceraurus ? sp. undt.

Plate xii, fig. 17.

Glabella subglobose, marked by two pairs of short furrows that are only seen when looking from the sides; occipital segment strong; occipital furrow well defined, also the dorsal furrows; fixed cheeks unknown except a fragment near the dorsal furrow. Length of glabella, 3^{mm}; width, 3.25^{mm}.

This curious little species is referred to the genus provisionally, as without other parts of the body its relations are not readily determined, and on the same account the specific identification is not attempted.

Formation and locality.—Pogonip Group, lower eastern slope of ridge next east of the Hamburg Ridge, Eureka District, Nevada.

Genus SYMPHYSURUS Goldfuss.

Symphysurus ? Goldfussi, n. sp.

Plate xii, fig. 16.

Glabella subclavate, convex, marked posteriorly by a pair of short, lightly impressed furrows; occipital ring strong and separated from the glabella by a well-defined but not deeply impressed furrow; dorsal furrows strong but shallow; fixed cheeks of medium width, rising from the dorsal furrows to the palpebral lobes, and sloping away to the front and back; frontal limb very short, hardly more than a line within the narrow border; postero-lateral limbs but little extended laterally, and marked by the extension of the occipital furrow across their posterior side.

Surface apparently smooth.

This species is referred to Symphysurus on account of the subclavate glabella, and the direction of the facial sutures. In the absence of the thorax and pygidium a close generic reference is almost impossible with many of the species represented only by fragments.

Formation and locality.—Pogonip Group, on the west slope of McCoy's Ridge, Eureka District, Nevada.

Genus BARRANDIA McCoy.

Barrandia ? McCoyi, n. sp.

Plate xii, fig. 5.

General form of glabella and fixed cheeks, exclusive of the extension of the postero-lateral limbs, subquadrate. Glabella oblong, widening out a little towards the broadly rounded front; general surface moderately convex, and unbroken by any glabellar furrows; occipital ring of average width; occipital furrow distinct, but not deeply impressed; dorsal furrows quite strong in the specimen illustrated, and less so in other examples; fixed cheeks of average width, broadest and most elevated at the eyelobes from which they slope to the front and back; eyelobes situated back of a line uniting their anterior margins with the center of the glabella; the front of the head is bordered by a narrow, flattened rim; postero-lateral limbs triangular, terminating at a distance from the dorsal furrow equal to one-half the length of the glabella exclusive of the occipital ring.

Surface smooth to the unaided eye.

After an examination of the various species referred to this genus by Mr. Salter, we find that the Eureka form differs from most of them in the more anterior position of the eyelobes and the stronger dorsal furrows; features that, without known differences in the thorax and pygidium to support them, we do not consider of generic importance. As the parts described, however, are all that is known of the species, the generic reference is somewhat provisional for this and also the following species.

Formation and locality.—Pogonip Group, on lower eastern slope of ridge east of the Hamburg Ridge, Eureka District, Nevada.

Barrandia ? sp. ?

Plate xii, fig. 6.

Glabella subclavate, the width of the base being about four-fifths of that of the anterior portion; front broadly rounded; general surface gently convex, curving down somewhat abruptly in front to the narrow, rim-like margin; occipital ring narrow and with a small tubercle at the center; occipital furrow shallow, but quite distinct; dorsal furrows clearly defined.

There are but slight traces of the fixed cheeks attached to the glabella. The species is characterized by the peculiarly shaped glabella.

Formation and locality.—Pogonip Group, on the west slope of McCoy's Ridge, Eureka District, Nevada.

Genus ILLÆNURUS Hall.

Illænurus Eurekensis, n. sp.

Plate xii, figs. 4, 4*a*.

Head of medium width, semi-elliptical; glabella subquadrate, convex, a little longer than wide, as 5 to 4, with scarcely perceptible occipital or dorsal furrows; palpebral lobes nearly central on the margins; frontal margin nearly straight; free cheeks a little longer than wide, with the base of the eyes cutting into them about the middle of the inner margin; genal angles broadly rounded.

The facial suture, cutting the frontal rim on a line with the outer edge of the eyelobe, passes directly to the anterior margin of the eyelobe; it encircles that and then curves gently outward to the posterior margin, forming a short, triangular-shaped lateral limb.

Surface minutely punctate.

The pygidiæ associated with the head parts vary very much. Two are illustrated on plate xii, figs. 12 and 19, neither of which has any resemblance to the pygidium of Illænurus. Another, discovered since the plate was prepared, shows a short, smooth axial lobe, slight dorsal furrows, and gently convex, broad lateral lobes; this is probably the pygidium of this species, as numerous examples of the glabella occur on the same fragment of rock.

In the fourth volume of the Geology of Wisconsin a species of Illænurus, *I. convexus*, is given as occurring in the Lower Magnesian limestone of that State, and the genus is also represented in the Potsdam sandstone, *Illænurus quadratus* Hall. In Nevada as yet it is only known from the horizon above that representing the Potsdam, or the correspondent of the Calciferous formation of the New York geologists.

Formation and localities.—Lower portion of the Pogonip Group, on the east slope of the ridge east of the Hamburg Ridge; on second ridge southeast of the Jackson mine; a little to the northeast of Adams Hill, and on ridge southwest of Wood Cone, Eureka District, Nevada. In the White Pine District, Nevada, it was found in the central portion of the Pogonip limestone on Pogonip Ridge.

Genus ASAPHUS Brongniart.

Asaphus Cariboucnsis, n. sp.

Plate xii, figs. 7, 7 *a*, *b*.

General form of the head semi-elliptical, moderately convex; glabella expanding quite rapidly in front of the eyelobes and obtusely angular in front; eyelobes situated back of a line uniting their anterior margins and the center of the glabella; postero-lateral limbs short and triangular in outline. The associated free cheek is a little longer than wide and with a distinctly marked border and genal spine

The pygidiæ occurring in the same hand specimens have a rather prominent medium lobe and smooth, depressed lateral lobes, without traces of segments on the latter.

Formation and localities.—Pogonip Group, in the lower portion associated with the preceding species, and also in the upper beds at the west base of Caribou Hill, Eureka District, Nevada.

Asaphus ? curiosa Billings.

Plate xii, fig. 15.

Asaphus ? curiosa Billings, 1865. Pal. Foss., vol. i, p. 318, fig. 305.

This curious pygidium, which is so closely allied to that described by Mr. Billings under the above name, shows traces of annulations on the median lobe when the outer shell is removed. Three specimens were obtained, but no associated parts of the head or thorax.

Fragments of two other species of Asaphus occur in the upper layers of the Pogonip Group. One from Caribou Hill has a broad, smooth, planulate pygidium with a very small and short median lobe, and is unlike any species known from American strata, being allied to some forms, described by Angelin, from Sweden. The other species is related to *A. Cariboucnsis*

FOSSILS OF THE DEVONIAN.

PORIFERA.

Genus PALÆOMANON Roemer.

Palæomanon Roemeri, n. sp.

Plate xiii, fig. 12.

This is a crateiform or cup-shaped sponge of the general form of those referred to the genus Manon of the Jurassic and Cretaceous, and for the reception of the Paleozoic types of which Dr. Roemer founded the genus Palæomanon, making *P. cratera* of the Niagara Group the type.

The example of *P. Roemeri* before me has a height of 65$^{\mathrm{mm}}$, and a diameter of 50$^{\mathrm{mm}}$, contracting below to form a rounded base; the outer wall extends vertically to within a short distance of the summit, where it curves inward to the rounded marginal rim of the shallow cup; this has a depth of 15$^{\mathrm{mm}}$. Owing to the complete silicification and change of the original spiculæ, none of the surface characters have been preserved; the unmistakable, striking form serves for the generic and specific identification.

Formation and locality.—Lower horizon of the Devonian limestone at Lone Mountain, 18 miles northwest of Eureka, Nevada.

Genus ASTYLOSPONGIA Roemer.

Astylospongia, sp. ?

Several specimens of a rather small, globose or flattened oviform sponge were obtained from the center of cherty concretions. The largest has a diameter of 30$^{\mathrm{mm}}$, and presents in a transverse section numerous fine, radiating tubes or canals studded with fine spiculæ. Owing to the imperfect preservation of all the specimens, it is impossible to determine their specific relations to forms already described.

Formation and locality.—Lower horizon of the Devonian limestone at Lone Mountain, 18 miles northwest of Eureka, Nevada.

Genus STROMATOPORA Goldfuss.

One or two species of this genus occurs very abundantly at several horizons throughout the Devonian formation. They are not in a condition to admit of specific determination without first having a series of thin sections prepared and a special study made in connection with other species, the material for which is not available at present.

ACTINOZOA.

Owing to the meagerness of the material representing some of the species, and the fact that much larger collections may be obtained for future study, it is not considered best to attempt to illustrate and describe this group until it can be done in a more satisfactory manner than at present. A short note of each of the identified species and a notice of such as are considered new and undescribed is given. The specific identifications were chiefly made by a direct comparison of the Nevada specimens with authenticated specimens in the beautiful and extensive collection of the New York State Museum and the private collection of Prof. James Hall.

Favosites hemispherica Yandell and Shumard. See Geol. Surv. Michigan, vol. iii, pt. 2, p. 25, 1876.

Several specimens of the cylindrical form of growth occur in the collections, but none of the large hemispheric or turbinate forms so characteristic of the species in the Corniferous limestone of New York, Ohio, Canada, etc.

Formation and localities.—Lower horizon of the Devonian limestone at Lone Mountain, 18 miles northwest of Eureka, and also at the head of the Reese and Berry Cañon, Eureka District, Nevada.

Favosites basaltica Goldfuss. 1829. Petref. Germ., vol. i, p. 78.

A comparison with the figures given by Goldfuss, and also with a specimen from Silesia, shows a very close specific resemblance between them and the Nevada specimens, and one of the latter appears to be specifically identical in all its characters with this species. Other specimens vary in the size of the cells from 2^{mm}, the usual size of those in *F. basaltica*, to 3^{mm}; smaller cells not over 1^{mm} in diameter occur on the same specimen. In the presence, however, of a single row of pores on each side of the cells, numerous transverse diaphragms, the general size of the cells, and the mode of growth, the species is similar to the European form of *F. basaltica.*

Formation and localities.—Lower horizon of the Devonian limestone at Lone Mountain, 18 miles northwest of Eureka; at the head of the Reese and Berry Cañon, and on the ridge of Atrypa Peak, Eureka District, Nevada.

Favosites, n. sp.

Corallum growing in hemispherical or irregularly formed masses made up of small tubes varying in size from 1^{mm} to 1.5^{mm}, which are without any distinct arrangement in relation to size, the smaller cells occurring together or with the larger interspersed among them. On the upper surface of the corallum the cell walls are thickened and have a beaded appearance which is not observed in a transverse section of the tubes a short distance below where the walls are strong and the tubes distinctly polygonal and not rounded as at the apertures. Transverse diaphragms entire, closely arranged or separated up to a distance equal to an entire diameter of the tube Mural pores not well determined, but there is apparently a single row of rather large size on each side.

The largest fragment obtained has a depth of 8^{cm}, and the diameter of the entire corallum was from 15^{cm} to 20^{cm}.

In the character of the cell-walls at the surface of the corallum, the diaphragms in the tubes, and form of growth, this species is not unlike *Favosites? Argus* Hall, of the Hamilton Group of New York, but in the small size of the cells, and the absence of the very large cells among the smaller ones in the latter species, it is very distinct from it.

Formation and locality.—Lower horizon of the Devonian limestone at Lone Mountain, 18 miles northwest of Eureka, Nevada.

Fistulipora, sp.?

Silicified specimens of a well-characterized species of this genus occur in association with fossils of the Upper Helderberg horizon. Its specific relations are not yet determined.

Formation and locality.—Devonian limestone, lower horizon, Atrypa Peak Ridge, Eureka District, Nevada.

Alveolites Rockfordensis Hall? 1864. Twenty-third Ann. Rep. N. Y. State Cab. Nat. Hist., p. 229.

The cell apertures open more directly with the plane of the surface in the Nevada specimens than in those from the Chemung Group of Iowa, but otherwise there is a marked specific similarity and a provisional reference is made to *A. Rockfordensis*, of the species from Nevada.

Formation and locality.—Upper horizon of the Devonian limestone, on ridge east of Yahoo Cañon, Eureka District, Nevada.

Cladopora pulchra Rominger? 1876. Geol. Surv. Michigan, vol. iii, pt. 2, p. 55.

The Eureka specimens although occurring in the upper beds of the Devonian are closely related to the Upper Helderberg species, *C. pulchra*, and appear to be specifically identical with it. The obtaining of more and better-preserved examples may prove the two forms to be specifically distinct, but with our present knowledge a separation does not appear to be necessary.

Formation and locality.—Upper horizon of the Devonian limestone, on ridge east of Yahoo Cañon, Eureka District, Nevada.

Cladopora, sp. (und't).

This is a larger branching form of which worn sections alone have been obtained. It occurs in the central or lower portion of the Devonian formation west of Spring Valley.

Numerous fragments of an imperfectly-preserved species of Cladopora occur in the silicious Devonian limestone; the stems are usually about 5^{mm} in diameter and associated with a species of Stromatopora in such quantities as to characterize many beds where other fossils are wanting.

Thecia ramosa Rominger? 1876. Geol. Surv. Michigan, vol. iii, pt. 2, p. 69.

This rare and interesting form occurs in the lower portion of the Devonian, corresponding to its position in the Upper Helderberg limestones at the Falls of the Ohio, and in the State of Michigan. Dr. Rominger describes it as formed of "stout, branching, sometimes reticulated, anastomosing stems, from half an inch to two inches in diameter, composed of thick-walled, conico-cylindrical tubes ascending and diverging from a central imaginary axis. Orifices unequal, of polygonal form, from one to two millimeters wide at the edges of the dilated margins, radiated by twelve prominent spinulose crests, extending through the whole length of the channels. Transverse diaphragms partly simple and complete, partly incomplete, represented by lateral squamiform, horizontal leaflets. Pores large and very numerous."

The species is represented by a single portion of a stem 28^{mm} in diameter; the polygonal, unequal orifices are about 1^{mm} in diameter and present the character given them by the author of the species, as do the diaphragms and large pores. Although there is no evidence of its being a branching form, as there is but a portion of a stem in the collections, it seems extremely probable from the close specific characters of the portion we have that it is specifically identical with the Upper Helderberg species.

Formation and locality.—Lower horizon of the Devonian limestone, central portion of Gray's Cañon, Eureka District, Nevada.

Syringopora Hisingeri Billings. 1859. Can. Jour., n. ser., vol. iv, p. 116.

In New York, Canada, Indiana, etc., this species occurs in the Upper Helderberg limestones, but at The Gate, northwest of Eureka, it is associated with fossils of the Chemung horizon in the Upper Devonian beds. Numerous fine specimens were found, so that the specific identification hardly admits of question.

Syringopora perelegans Billings. 1859. Can. Jour., n. ser., vol. iv, p. 117.

Specimens referable to this species were found in the Lower Devonian beds at Lone Mountain, and also at the summit of the formation at The Gate, northwest of Eureka, showing its range through the entire Devonian formation. It is extensively distributed in the strata of the hills east and west of Yahoo Cañon. At the east it occurs in the Upper Helderberg limestones.

Aulopora serpens Goldfuss? See Geol. Surv. Michigan, vol. iii, pt. 2. 1876.

In size, manner of branching and reuniting of the tubes, this species of Aulopora from the Lower Devonian beds of Gray's Cañon corresponds to the descriptions and illustrations given of the American form identified with that species, and a comparison with the figures given by Goldfuss indicates that this identification is correct, although his figures show a somewhat smaller and less robust form.

Cyathophyllum corniculum Milne-Edwards? See Geol. Surv. Michigan, vol. iii, pt. 2, p. 102.

A direct comparison with examples of this species from the Upper Helderberg limestones at the Falls of the Ohio shows very little difference between them and a similar form from the upper beds at The Gate, northwest of Eureka, where it is associated with *Syringopora Hisingeri*, another Upper Helderberg species. Until more perfect specimens are obtained a provisional reference is made as above.

Cyathophyllum rugosum Edwards and Haime. See Geol. Surv. Michigan, vol. iii, pt. 2, p. 106. 1876.

Well-marked silicified specimens of this species occur in association with *Cyathophyllum Davidsoni* and *Diphyphyllum Simcoense*, in the Lower Devonian of Lone Mountain. They are usually more or less subhemispherical masses with occasional cells of much larger size than distinguished the Upper Helderberg examples from the Falls of the Ohio; otherwise no essential differences were observed.

Cyathophyllum Davidsoni Milne-Edwards. See Geol. Surv. Michigan, vol. iii, pt. 2, p. 107. 1876.

Occurs with the preceding species, and is readily identified with the forms from the Hamilton Group of Iowa. It appears to be little more than a small-celled form of the associated *C. rugosum*.

Cyathophyllum, n. sp.

A compound corallum formed of corallites that increase by calicular and interstitial gemmation. The corallites are usually circular, and vary from 3^{mm} to 25^{mm} in diameter in the same specimen. Frequently several will spring from the calyx of an old corallite, increase rapidly in size, forming a subturbinate form, with a calyx broad and expanded about the margin, and having a rather deep central depression, the bottom of which is sometimes evenly rounded, and again with a small central protuberance formed by the union of the radiating lamellæ. The interstitial corallites start from the sides of the older ones and arise alongside, usually remaining at the same relative height with the general surface of the corallum; the young or smaller corallites wanting the broad margin to the calyx, the deep depression occupying the entire area.

The lamellæ are crenulated on the margin and number from 50 to 60 in the circumference of the calyx.

The interlamellar spaces are divided by numerous transverse plates; the central transverse diaphragms are very small if present at all.

This is a very distinct and handsome species allied to *C. rugosum*, or what that species would be if growing in the same manner. Still, it does not appear that the two are specifically identical. It grows in quite large masses, as a fragment shows a depth of 15^{cm}.

Associated with the preceding species at Lone Mountain, 18 miles northwest of Eureka, Nevada.

Cyathophyllum, n. sp.

Single conical polyparia, annulated by coarse undulations of growth, and longitudinally striated by the septal furrows. The bases of root-like prolongations from the outer surface often obscure these features. Calyx very deep and opening out rapidly. A specimen 35^{mm} in height has a calyx 22^{mm} in depth, with a diameter of 26^{mm} at the margin. Lamellæ from 50 to 60 in number. This is a strongly marked form, unlike any other known to me.

Associated with the preceding species.

Acervularia pentagona Goldfuss. See Geol. Expl. Fortieth Par., vol. iv, p. 31. 1877.

In the Paleontologic report of the Geological Exploration of the Fortieth Parallel, Mr. F. B. Meek has identified this species from the Devonian limestones of the White Pine Mountains, and given an illustration of the Nevada specimens. The species, as it occurs in the Middle Devonian, at the head of Brown's Cañon, is essentially the same as at White Pine, and there appears to be no question of its identity with the European species.

Pachyphyllum Woodmani (White) H. & W. 1864. Twenty-third Ann. Rep. N. Y. State Cab. Nat. Hist., p. 231.

This is a strongly marked species, and a comparison of specimens from the typical locality at Rockford, Iowa, with those from Nevada, shows no appreciable differences between the Chemung form and the Upper Devonian specimens occurring on the ridge west of Yahoo Cañon, in the Eureka District.

Diphyphyllum Simcoense Billings. See Geol. Surv. Michigan, vol. iii, pt. 2, p. 123. 1876.

This very abundant species of the great Corniferous coral reef of Canada, New York, Indiana, etc., is represented by a number of specimens from Lone Mountain, but not found elsewhere. The stems forming the colonies or corallum are larger than the average in the species, but the specific identity of the eastern and western species is a very close one.

Cystiphyllum Americanum Milne-Edwards. See Geol. Surv. Michigan, vol. iii, pt. 2, p. 138. 1876.

As there is considerable variation in the size and form of the polyparia and the vesicles, as well as the distinctness of the plications, in the forms referred to this species, it is quite probable that the one under consideration will fall within its limits. It presents all the characters common to many New York and Ohio specimens, and we have little hesitancy in referring it to this species.

Formation and localities.—Lower horizon of the Devonian limestone; on the divide at the head of the Reese and Berry Cañon, and at Lone Mountain, 18 miles northwest of Eureka, Nevada.

Cystiphyllum, n. sp.

There are two species of Cystiphyllum in the collection that do not appear to be specifically allied to any described forms. One has the outer surface studded with little nodes and the calyx of considerable depth, with numerous sharp lamellæ that in some instances are nearly concealed by coarse vesicles. The corallum is about 40^{mm} in length, 20^{mm} to 25^{mm} in diameter at the summit, and more or less strongly marked by broad ridges of growth. The other species has the latter character in a modified degree, but lacks the nodulose surface; the interior of the calyx is filled with vesicles from the center of which a young corallum springs.

At Lone Mountain with the preceding and other species.

Besides the above-mentioned forms, there are two species of Zaphrentis too imperfect for description, and a large Cyathophylloid coral of unknown specific relations.

BRACHIOPODA.

Genus LINGULA Bruguière.

Lingula Læna Hall.

Plate xiii, fig. 2.

Lingula leana Hall, 1867. Pal. N. Y., vol. iv, p. 9, pl. ii, fig. 12.

The Nevada shell is not quite as elongate or rounded in front as much as the New York examples of this species, but it agrees with them in all essential particulars. It is a rare species, both in the Hamilton Group of New York and the lower horizon of the Devonian formation at Lone Mountain, 18 miles northwest of Eureka, Nevada.

Dimensions: length, 17^{mm}; greatest breadth, 12^{mm}.

Lingula Ligea Hall.

Plate ii, fig. 2.

Lingula ligea Hall, 1860. Thirteenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 76.
Ibid., 1867. Pal. N. Y., vol. iv, p. 7, pl. i, fig. 2*a*, *b*; pl. ii, fig. 8.

This pretty and symmetrical little shell is represented by one specimen that in external appearance is identical with specimens of *L. Ligea* now before me, from the Hamilton Group of New York.

In a layer of limestone, about 50 feet above that containing the above-mentioned shell, a number of examples of a form that may be only a variation of *L. Ligea* were collected. In as close a genus as Lingula, however, this variation is unusual, and a varietal distinction is made.

Lingula Ligea var. Nevadensis, n. var.

Plate ii, fig. 3.

Shell below the average size of *L. Ligea*, and with more rounded sides and pointed beaks than that species.

Surface marked by fine concentric striæ of growth.

The interior of the ventral valve shows the path of advance of two central muscular scars, and also a lateral scar on each side. The impressions of the scar are too faint to be of any service in determining their character or number.

Formation and locality of this and the preceding species, Upper Devonian of Rescue Hill, Eureka District, Nevada.

A species undistinguishable from this occurs in the Lower Devonian of the south slope of Sentinel Mountain, Eureka District, Nevada.

Lingula Alba-pinensis, n. sp.

Plate ii, figs. 1, 1 *a*.

Shell small, elongate, elliptical, moderately convex; beaks obtusely angular; sides of shell curving with a gentle convexity from the lateral cardinal slope to the rather abruptly rounded front.

Surface marked by fine concentric striæ and rather strong lines of growth for so small a species. No radiating lines have been observed.

Dimensions: length of the largest specimen found, 6^{mm}; width at center, 3^{mm}. The other specimens average 2.5^{mm} in length by about 1.5^{mm} in width.

Associated with these there is a minute form that differs in being more broadly elliptical; otherwise it may be referred to *L. Alba-pinensis*. The latter species belongs to the Devonian Group of Lingula, of which *L. Melie* and *L. Ligea* are types, and is also very much like the young of *L mytiloides* of the Carboniferous.

In the Eureka District *Lingula Melie* (see pl. ii, fig. 4) is the only Lingula yet discovered in the White Pine shale.

Formation and locality.—Upper Devonian, White Pine shale, White Pine District, Nevada.

Lingula Lonensis, n. sp.

Plate xiii, figs. 1, 1 *a*.

Shell broadly ovate; beaks obtusely angular, the sides sloping away at an angle of about 110°, and then extending forward with more or less convexity to the broadly rounded front.

Surface marked by numerous lines of growth that give a finely imbricated appearance to the outer portions of the shell. No radiating lines or striæ are visible on the specimens before us. Two specimens measure: length, 10^{mm}; width, 8^{mm}; length, 11^{mm}; width, 10^{mm}, respectively.

The specimens are imbedded in a shaly limestone, and are very much compressed, which gives them a broader outline than when in a natural condition.

The species is allied to *Lingula Lucretia* Billings (Pal. Foss., vol. ii, pt.

1, p. 13, fig. 3. 1874), from the Gaspé limestone, but differs in surface characters.

Formation and locality.—In the lower horizon of the Devonian limestone of Lone Mountain, 18 miles northwest of Eureka, Nevada.

Lingula Whitei, n. sp.

Plate xiii, fig. 3.

Shell above the average size, subelliptical in outline, the length and breadth as 5 to 3; the cardinal slopes of the dorsal valve converge at an angle of 20°; front broadly rounded and sides subparallel, curving slightly outward. The dorsal valve is quite convex and a little flattened along the center towards the front.

Surface marked by fine concentric and radiating striæ, and when the outer shell is partially decorticated strong radiating lines, crossed by raised concentric striæ, give a somewhat reticulated appearance to the surface. The length of the specimen described is 29^{mm} and the breadth 17^{mm}.

The general outline of the species is similar to that of *Lingula squamiformis* Phillips (Mon. Brit. Foss. Brach. Davidson, vol. ii, p. 205, pl. xlix, figs. 1–10), of the Carboniferous rocks, but the valves are more convex and the scars on the interior of the dorsal valve differently arranged. I know of no closely related Devonian species.

A cast of the interior of the dorsal valve was obtained from a fragment of limestone in which the shell adhered to the matrix by its exterior surface and left the imprint of the vascular markings and muscular scars beautifully and distinctly defined on the cast. It is of great interest, as it affords the opportunity for the comparison of the structure with that of living forms of the genus, and shows that the strong generic resemblance of the outer surface of the shell to that of recent species is also present in the more important muscular scars on the interior surface.

At the posterior end, just within the apex of the valve, the cast of the elongate divaricator muscular scar (*d*, plate xiii, fig. 3) is well impressed; it is transverse and arches forward a little at the sides, back of the initial points of the path of the advance of the posterior adductor and adjustor muscular scars. The posterior adductor scars (*pa*) are large, elongate-oval in outline, and so situated that their anterior portions cross a line drawn through the transverse center of the valve, while the posterior ends point back to their path of advance; they are separated by the track of advance of the anterior adductor scars (*aa*), which are seen just in advance of them as very small, slightly impressed oval spaces. The area of the adjustor muscular scars (*ad*) and their path of advance is, as a whole, more or less triangular, and situated one on each postero-lateral portion of the valve. The front margin of the area is rather broad and divided into four small, somewhat indistinct lobes; posteriorly the area contracts to the initial point of the path of advance; two scars appear to be defined on the anterior two-thirds of each area; they are elongate and include two of the little lobes of the anterior margin within the area of each, and appear to represent the point of attachment of the exterior and posterior adjustor muscles; there is a small space divided off by raised lines that may be the central adjustor scar, but it is not clearly defined.

Between the areas of the adjustor scars and the large central area of the adductors there is a sharp, narrow ridge that distinctly separates them. A narrow elongate area (*pp*), outside of the area of the adjustor scars, was probably the point of attachment of the posterior parietal muscle, and the lateral and outer walls of the perivisceral cavity seem to have left evidence of their presence on the margins (*w*) of the central area.

The great pallial sinuses approximate quite closely towards the front, curving gently outward and backward around the central area to opposite the anterior margin of the area of the adjustor muscular scars, around which they curve to the narrow margin just within the exterior border of the shell; their further course cannot be traced, but, from the narrow area between the posterior parietal area and the margin, the sinuses must have been very narrow, and with very minute, if any, lateral or internal ramuscules. The anterior lateral ramifications of the sinuses are strongly defined as they spring from the main sinus, becoming smaller and bifurcating or branching towards the margin of the valve; no inner ramifications are to be seen on the space (*i*) between the great sinus and the perivisceral area on the dorsal valve, a feature, however, that is well shown on a fragment of a ventral valve, where this area and the space occupied by the anterior adductor scars in the dorsal valve is occupied by the short, strong ramuscules from the great sinuses. Over the central portion of the cast the radiating lines of the inner surface of the shell are seen crossing the muscular scars and vascular markings, and somewhat complicate the study of the latter. The draughtsman has represented these, as also all the details, with accuracy.

On comparing this with the interior of the corresponding valve of *Lingula Elderi*, of the Trenton limestone of Wisconsin, described by Prof. R. P. Whitfield,[8] we observe in the latter the strong extension of the great pallial sinuses nearly around the posterior end of the perivisceral cavity and back of the divaricator scar; the greater anterior expansion of the pallial sinuses, and the smaller area of the adjustor muscular scars. The former character is unknown in *L. Whitei*, but is present in the recent species so beautifully illustrated by Hancock.[9]

The two paleozoic species possess, however, the large posterior adductor scars, the postero-lateral adjustor scars, and the absence of the inner ramuscules of the posterior extension of the pallial sinuses, features that distinguish them from *Lingula anatina* and other living species.

The character of the anterior ramifications of the great sinuses of *L. Whitei* resembles that of *L. affinis* more closely than that of any other species.

To afford the means of a direct comparison between the Silurian, Devonian, and a recent Lingula, an outline figure of the interior of the dorsal valve of a species from each horizon is given on plate xxi, figs. 18, 19, and 20, in which the muscular scars and vascular markings of each are shown.

The specific name of the Devonian species is given in honor of Dr. C. A. White, geologist and paleontologist.

Formation and locality.—Lower portion of the Devonian limestone, southwest spur of Atrypa Peak, Eureka District, Nevada.

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[8] Amer. Jour. Sci., 3d ser., vol. xix, p. 472, 1880.

[9] Organization of the Brachipoda, by Albany Hancock, esq., 1858. Trans. Royal Phil. Soc., pls. 64–66.

Genus DISCINA Lamarck.

Discina minuta Hall.

Plate xiii, fig 5.

Orbicula minuta Hall, 1843. Geol. Rep. Fourth District of New York, p. 180.
Discina minuta Hall, 1867. Pal. N. Y., vol. iv, p. 16, pl. i, fig. 16 *a–b*.

This small and pretty species is represented by a number of examples that correspond closely with the typical specimens from the Marcellus shale of New York, and which are considered identical with them, although separated by a distance of 1,800 miles, and occurring at a different horizon in the Devonian Group.

The New York specimens vary from 1.5^{mm} to 4^{mm} in diameter, while the largest from Nevada is 4^{mm} in its greater diameter, and of about the same convexity as examples of the same size from New York.

Formation and locality.—Upper horizon of the Devonian limestone, at The Gate, northeast of Eureka, Nevada.

Discina, sp. (?)

Considerable interest is attached to this shell, as it is very rare and the only species of the genus from the Lower Devonian of the Rocky Mountain area, but one imperfect specimen showing the two valves united occurs in the collections. In general form it is not unlike *Discina media* of the Hamilton Group of New York.

Formation and locality.—Lower Devonian of Lone Mountain, 18 miles northwest of Eureka, Nevada.

Discina Lodensis Hall.

Plate ii, figs. 5, 5 *a*.

Orbicula lodensis Hall, 1843. Geol. Rep. Fourth Dist. N. Y., p. 223.
lodensis Vanuxem, 1842. Geol. Rep. Third Dist. N. Y., p. 168. (Wood cut used in advance of publication of the Report on the Fourth District.)
Discina lodensis Hall, 1867. Pal. N. Y., vol. iv, p. 22, pl. i, figs 14 *a–f;* pl. ii, fig. 35.
lodensis Rathbun, 1874. Bull. Buffalo Soc. Nat. Sci., vol. ii, p. 257. *Ibid.*, 1878 Proc. Boston Soc. Nat. Hist., vol. xx, p. 17.
Compare *D. media* Hall, 1857. Pal. N. Y., vol. iv, p. 20, pl. ii, figs. 25–28.

On a direct comparison with authentic specimens of this species from the Genesee slate of New York, no differences appear that are of specific value.

Professor Hall says, in comparing *D. media* of the Hamilton Group of New York with *D. Lodensis*, that the former may possibly be only a well-marked variety of *D. Lodensis* (*ibid.*, p. 21). In this I would fully concur. In studying a good series of *Discina nitida*, as illustrated by Davidson, considerable range of variation in convexity, outline, and the position of the apex is apparent, and no doubt other species are subject to as great variations, arising, as they may, from the nature of the local environment during the life of the animal; the character of the sediments and conditions of fossilization.

Mr. Rathbun identifies this species from the Devonian of Brazil, S. A.

Formation and locality.—Upper Devonian. White Pine shale on the east side of Applegate Cañon, White Pine Mining District, Nevada.

PHOLIDOPS Hall.

Pholidops bellula, n. sp.

Plate ii, figs. 6, 6*a*, *b*.

Shell minute, broadly oval, depressed; apex eccentric, situated about one-third the distance between the anterior and posterior margins.

Surface marked by a few fine concentric striæ.

The interior of the dorsal valve presents a rather wide, unbroken margin surrounding the rounded concave interior. Near the center of the shell two oval, slightly-oblique elevated scars occur. No other scars are discernible. In the cast the bilobed scars are shown as a rather deep impression, the apex of the shell being entirely truncated. Substance of the shell calcareous. Average size, 2.5^{mm} by 2^{mm}. No ventral valves were discovered.

In general form this species resembles *Pholidops ovalis* Hall, (Twenty-eighth Ann. Rep. N. Y. State Mus. Nat. Hist., p, 149, pl. xxi, figs. 1, 2) of the Niagara Group, and *P. Hamiltoniæ* Hall (Pal. N. Y., vol. iv, p. 32, pl. iii, figs. 6–9, 1867) of the Hamilton Group of New York. It differs from each, and is specifically distinct from any form with which we are acquainted.

Formation and locality.—Lower Devonian of Brush Peak, Eureka District, and at the same horizon at Lone Mountain, 18 miles northwest of Eureka, Nevada.

Pholidops quadrangularis, n. sp.

Plate ii, fig. 7.

Shell broadly oval, or subquadrangular; moderately elevated. Sides nearly straight, which gives the quadrangular outline to the shell. Apex eccentric and a little elongate. Slope from the apex to the margin uniform. Surface marked by irregular, not very prominent lamellose striæ. Substance of shell calcareous. Dimensions: Breadth, 5.5^{mm}; length, about 6.5^{mm}.

This species is unlike any described form known to us, and although only represented by a single valve showing the exterior, it is too well marked to be confused with any species from the Eastern United States.

Formation and locality.—Lower Devonian at Lone Mountain, 18 miles northwest of Eureka, Nevada.

Genus ORTHIS Dalman.

Orthis McFarlanei Meek.

Orthis Mc.Farlanei Meek, 1868. Trans. Chicago Acad. Sci., vol. i, p. 88, pl. xii, figs. 1 *a–h*.

This large species is so strongly marked by its peculiar form that the identification is rendered very satisfactory, although based on imperfect specimens. Its short hinge line, great convexity of the dorsal valve, and narrow umbonal region give it the appearance of *Pentamerus galeatus*, as mentioned by Meek. The Nevada specimens show the fine radiating striæ and minutely punctate surface with great distinctness, as in the original types of the species from the Mackenzie River Basin, British America. Mr. Meek states that he had seen specimens which he believed to be identical with this species from the Devonian of Iowa and Illinois.

Formation and locality.—Lower horizon of the Devonian limestone, west slope of County Peak, Eureka District, Nevada.

Orthis impressa Hall.

Plate xiii, fig. 13.

Orthis impressa Hall, 1843. Geol. Rep. Fourth District of New York, p. 268 and p. 267, fig. 2.
impressa Hall, 1867. Pal. N. Y., vol. iv, p. 60, pl. viii, figs. 11-19.
impressa Whitfield, 1883. Geol. of Wisconsin, vol. iv, p. 326, pl. xxv, figs. 13-15.
Compare *O. Tulliensis* Vanuxem, 1842, Geol. Rep. Third District, New York, p. 55.
O. Iowensis Hall. 1858, Geol. Surv. Iowa, vol. i, pt. 2, p. 488, pl. ii, figs. 4 *a-i*, and *O. Mc. Farlanei*, Meek, *loc. cit.*, p. 114.

In New York this species is found in the Chemung Group, and is regarded by Professor Hall as closely allied to *Orthis Tulliensis*, of the Tully limestone, which occurs about 1,000 feet lower in the strata, no species of Orthis being known in the interval. In Nevada the relative position of the two forms is somewhat reversed; *O. impressa* is found only at the base of the Devonian, and *O. Tulliensis* at the base and near the summit, 4,000 feet above.

A comparison of the Chemung specimens from New York with the Nevada examples shows a most perfect identity between them, while the *O. Tulliensis* is quite as decided in its characters as in New York. Associated with *O. impressa*, at Lone Mountain, there is a more convex form that is of the type of *O. Tulliensis*, and it may be referred to it.

Formation and localities.—Lower horizon of the Devonian limestone, Comb's Peak; 2 miles east of Castle Mountain; west slope of County Peak, and Lone Mountain, 18 miles northwest of Eureka, Eureka District, Nevada.

Orthis Tulliensis Vanuxem.

Plate ii, figs. 12, 12*a*.

Orthis tulliensis Vanuxem, 1842. Geol. Rep. Third District New York, p. 164 and fig. 2, on p. 163.
tulliensis Hall, 1867. Pal. N. Y., vol. iv, p. 55, pl. vii, figs. 5*a-k*.
Compare *O. Iowensis* Hall, 1858. Geol. Rep. Iowa, vol. i, pt. 2, p. 488, pl. ii, figs. 4*a-i*.

The facts connected with the distribution and range of this species have been mentioned in the notes of the preceding species. The specimens from The Gate, northwest of Eureka, are not quite as gibbose as the majority of the New York examples, but their specific identity is unquestionable. The specimens from the lower horizon at Lone Mountain are preserved in a different matrix and the outer surface is mostly exfoliated, which gives them a dissimilar appearance, but no specific variation can be determined between them and those from the upper horizon at The Gate.

Formation and localities.—Devonian limestone, higher beds at The Gate, northwest of Eureka, and lower beds at Lone Mountain, 18 miles northwest of Eureka, Nevada.

Genus SKENIDIUM Hall.

Skenidium Devonicum, n. sp.

Plate xiii, figs. 4, 4 *a*.

Shell small, subpyramidal; hinge line a trifle shorter than the greatest width of the shell; a sharp, median fold marks the ventral valve and a slight sinus the dorsal. Ventral valve elevated, beak slightly incurved over a high area that is divided midway by a large deltoidal foramen. Dorsal valve nearly flat; area very short; foramen short and broad; cardinal process extends as a median septum towards the lower portion of the valve.

Surface marked by strong radiating striæ that increase by implantation.

Dimensions: length, 3.5^{mm}; breadth, 4.5^{mm}; elevation of ventral valve, 1.5^{mm}.

This species has a less elevated area, finer and sharper striæ than *Skenidium insignis*=(*Orthis insignis* Hall, Pal. N. Y., vol. iii, p. 173, pl. xiii, figs. 13–15, 1859) of the Lower Helderberg limestone of New York; otherwise the two strongly resemble each other.

This is the first time that the genus Skenidium has been reported as occurring in Devonian strata, the species previously referred to it coming from the Lower and Upper Silurian formations.

Formation and locality.—Devonian limestone, lower horizon, Lone Mountain, 18 miles northwest of Eureka, Nevada.

Genus STREPTORHYNCHUS King.

Streptorhynchus Chemungensis Conrad (Sp.).

Plate xiii, figs. 7, 16.

Strophomena Chemungensis Conrad, 1842. Jour. Acad. Nat. Sci. Philad., vol. viii, p. 257.
  bifurcata Hall, 1842. Geol. Rep. Fourth District New York, p. 266, fig. 2.
  arctostriata Hall, 1842. *Ibid.*, p. 266, fig. 3.
  pectinacea Hall, 1842. *Ibid.*, p. 266, fig. 4.
Orthis perversa Hall, 1857. Tenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 137.
  inequalis and *O. pravus* Hall, 1858. Geol. Iowa, vol. i, pt. 2, p. 490.
Streptorhynchus Pandora Billings, 1860. Canadian Jour., vol. v, p. 266, and Geology of Canada, 1863, p. 369, fig. 384.
Orthisina arctostriata Hall, 1860. Thirteenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 80.
  alternata Hall, 1860. *Ibid.*, p. 81.
Streptorhynchus Chemungensis Hall, 1867. Pal. N. Y., vol. iv, p. 67, plates iv, ix, x.
  var. A. *Streptorhynchus pandora* Billings.
  var. B. *S. arctostriata* Hall.
  var. C. *S. perversa* Hall.
  var. D. *S. pectinacea* Hall, 1867. Pal. N. Y., vol. iv, pp. 68–73.
  Pandora Nicholson, 1874. Pal. Prov. Ontario, p. 70.
Hemipronites Chemungensis, var. *arctostriata* Meek, 1877. Geol. Expl. Fortieth Par., vol. iv, p. 35, pl. iii, fig. 2.

Three quite distinctly marked varieties of this extremely variable species were collected from the Devonian limestone of Lone Mountain and the Eureka District.

The first is that of the typical form of shell described by Conrad, many illustrations of which are given by Professor Hall in volume four of the Paleontology of New York (plate x, figs. 11–17). The Nevada form is shown on our plate xiii, fig. 16. Another, and by far the most abundantly represented variety, is var. *Pandora* (Pal. N. Y., vol. iv, pl. iv, figs. 11–19; pl. ix, figs. 18–25, 27; and pl. x, fig. 1).

In New York the species ranges from the Upper Helderberg up into the Chemung Group, and in the Eureka District from the base to the summit of the Devonian limestone. At The Gate, northwest of Eureka, the small form characteristic of the Chemung Group of New York, also of the Corniferous limestone of the Upper Helderberg, occurs in a dark limestone. This is the exact locality from which the specimen mentioned by Mr. Meek was obtained and referred by him to the variety *arctostriata*. The specimen as figured by Mr. Meek is like those before me, one of which (plate xiii, fig. 7) varies slightly from his figure and those illustrated by Professor Hall (Pal. N. Y., vol. iv, pl. x, figs. 1, 2.)

The other variety represented in Nevada, var. *perversa*, is limited to the Lower Devonian horizon, although found at somewhat widely separated localities. In New York, it is found both in the Upper Helderberg and Hamilton Groups.

Formation and localities.—Devonian limestone, Lone Mountain, 18 miles northwest of Eureka, and several localities within the Eureka District, Nevada; also on north end of the Piñon Range, Nevada.

Genus STROPHOMENA Blainville.

Strophomena rhomboidalis Wilckens (Sp.).

For synonyms, see Davidson's Monograph of the British Silurian Brachiopoda, vol. iii, p. 281; and Pal. N. Y., vol. iv, p. 76.

This widely-distributed species was found in but one locality on Lone Mountain, not being recognized within the limits of the map of the Eureka District. The specimens are of the ordinary character, with rather strong concentric undulations. They are associated with *Strophodonta perplana*, *S. ampla*, and *Streptorhynchus Chemungensis*, var. *Pandora*.

The species has been recognized in the Lower Carboniferous of Utah, and at the same horizon in the Spring Mountain Range of Nevada, but not before in the Devonian of the Rocky Mountain.

Formation and localities.—Lower Devonian horizon of Lone Mountain, 18 miles northwest of Eureka, Nevada; also in the Lower Devonian, on the north end of the Piñon Range, Nevada.

Genus STROPHODONTA Hall.

Strophodonta demissa Conrad (Sp.).

Plate ii, figs. 9, 9 *a*, *b*.

Strophomena demissa **Conrad, 1842. Jour. Acad. Nat. Sci. Philad., vol. viii, p. 258, pl. xiv, fig. 14.**

Strophodonta dimosa **(?) Owen, 1852. Geol. Surv. Wis., Iowa, and Minn., tab. iii, A, fig. 14.**

Strophomena (*Strophodonta*) *demissa* Hall, 1857. Tenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 137.
Strophodonta demissa Hall, 1858. Geol. Iowa, vol. i, pt. 2, p. 495, pl. iii, fig. 5.
Strophomena demissa Billings, 1861. Canadian Jour., vol. vi, p. 341, figs. 116–118.
demissa Billings, 1863. Geology of Canada, p. 367, figs. 377 *a–d*.
Strophodonta demissa Hall, 1867. Pal. N. Y., vol. iv, pp. 81, 101, and 114, pls. xi, xii, xvii, xix.
Strophomena (*Strophodonta*) *demissa* Meek, 1868. Trans. Chicago Acad. Sci., vol. i, p. 87, figs. 6 *a–c*.
Strophodonta demissa Nicholson, 1873. Pal. Prov. Ontario, p. 65.
demissa Whitfield, 1883. Geol. of Wisconsin, vol. iv, p. 327, pl. xxv, fig. 18.

This species in New York occurs throughout the Devonian. It has also been found in Illinois, Iowa, and to the far Northwest, in the Mackenzie River Basin In the Eureka District it is restricted, as far as known, to the Lower Devonian horizon. The specimens are below the average size of those from the Hamilton Group of New York, corresponding in this respect to the Upper Helderberg form; they are also more finely striated.

Formation and localities.—Lower horizon of the Devonian limestone, midway of Gray's Cañon, Eureka District, and at Lone Mountain, 18 miles northwest of Eureka, Nevada.

Strophodonta Patersoni Hall.

Strophomena (*Strophodonta*) *patersoni* Hall, 1857. Tenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 114.
Strophomena Patersoni? Billings, 1861. Can. Jour., vol. vi, p. 340, fig. 115.
Strophodonta patersoni Hall, 1867. Pal. N. Y., vol. iv, p. 89, pls. xii, xiii.
Strophomena Patersoni Nicholson, 1873. Pal. Prov. Ontario, p. 67.

There is but one specimen of the ventral valve of this species in the collection, but its depressed convex form, arching wrinkles between the coarser striæ, and the fine intermediate radiating striæ give it all the prominent characters of the species. In New York and Canada, *S. Patersoni* is an Upper Helderberg species, not being known in the Hamilton or Chemung Groups. Its horizon in New York and Canada is the equivalent of the Lower Devonian horizon in the Eureka District.

Formation and locality.—Devonian formation, lower horizon, Lone Mountain, 18 miles northwest of Eureka, Nevada.

Strophodonta inequiradiata Hall.

Plate 11, figs. 11, 11*a*.

Strophomena (*Strophodonta*) *inequiradiata* Hall, 1857. Tenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 113.
inæquistriata Billings, 1861. Can. Jour., vol. vi, p. 338, fig. 113. *Ibid.*, Geology of Canada, 1863, p. 367, fig. 375.
Strophodonta inequiradiata Hall, 1867. Pal. N. Y., vol. iv, p. 87, pls. xi, xii, xiii.
Strophomena inequiradiata Billings, 1874. Pal. Foss., vol. ii, pt. 1, p. 24.

This species is closely allied to *S. Patersoni*, as is shown by a series of specimens from the Upper Helderberg Group of New York. The Nevada specimens, however, represent the well-marked characters of each species, so that there is little danger of mistaking one for the other. They occur at the same stratigraphic horizon, but in localities 15 miles distant from each other.

Formation and locality.—Lower horizon of the Devonian limestone, Comb's Peak, Eureka District, Nevada.

Strophodonta perplana Conrad (Sp.).

Plate xiii, fig. 11.

Strophomena perplana Conrad, 1842. Jour. Acad. Nat. Sci. Philad., vol. viii, p. 257, pl. xiv, fig. 11.
pluristriata Conrad, *idem.*, p. 259.
delthyris Conrad, *idem.*, p. 258.
crenistria Hall, 1843. Rep. Fourth Geol. District New York, p. 171.
nervosa Hall, *idem.*, p. 266, fig. 1.
Strophodonta fragilis Hall, 1857. Tenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 143.
fragilis Hall, 1858. Geol. Rep. Iowa, vol. i, pt. 2, p. 496, pl. iii, figs. 6 *a–c*.
Strophomena perplana Billings, 1861. Can. Jour., vol. vi, p. 343.
Strophodonta perplana Hall, 1867. Pal. N. Y., vol. iv, pp. 92, 98, and 113, pls. xi, xiii, xvii, and xix.
Strophomena perplana Nicholson, 1873. Pal. Prov. Ontario, p. 64.

This well-marked species ranges from the lower horizon to nearly the summit of the Devonian limestone. It is represented by a number of specimens which, although somewhat imperfect, exhibit the general outline, slight convexity, and fine surface striæ of the ventral valve, as also the large flabelliform divaricator muscular impressions. In New York it is found to pass from the Upper Helderberg through the Hamilton and into the Chemung Group. Its geographic range also includes the Province of Ontario, Canada, and the States of Illinois and Iowa.

Formation and localities.—Devonian limestone, Comb's Peak and Newark Mountain, Eureka District; Lone Mountain, 18 miles northwest of Eureka, Nevada.

Strophodonta punctulifera Conrad (sp.)

Plate xiii, fig. 10.

For list of synonyms and remarks, see Paleontology of New York, vol. iii, p. 188; vol. iv, p. 95; Pal. Province of Ontario, p. 68.

This species has usually been considered a Lower Helderberg form, although, as stated by Professor Hall, Mr. Billings, and Professor Nicholson, it is closely allied to, if not identical with *S. ampla*, of the Upper Helderberg and Hamilton Groups. The Nevada specimens show a convex dorsal valve, slightly concave about the umbo, with strong radiating striæ and punctate surface, the latter showing where the surface is covered with fine concentric striæ. The Nevada shell is not referable to *S. ampla*, as found in New York, and as it approaches *S. punctulifera* very closely the reference is made to that species.

Formation and locality.—Lower horizon of the Devonian limestone, Lone Mountain, 18 miles northwest of Eureka, Nevada.

Strophodonta arcuata Hall ?

Strophodonta arcuata Hall, 1858. Geol. of Iowa, vol. i, pt. 2, p. 492, pl. iii, figs. 1 *a–c* 2 *a*, *b*, *e*, *f*.
Calvin, 1878. Bull. U. S. Geol. Survey, vol. iv, p. 728.

A comparison with specimens from Rockford, Iowa shows the Nevada shell to be less convex than the average examples, but not less so than some. It agrees otherwise in nearly every particular.

Formation and locality.—Devonian limestone, south spur of Atrypa Peak, Eureka District, Nevada.

Strophodonta Calvini Miller.

Plate xiii, fig. 6.

Strophodonta quadrata Calvin, 1878. Bull. U. S. Geol. Survey, vol. iv, p. 728. Not of Swallow, 1860. Trans. St. Louis Acad. Sci., vol. i, p. 639.
Calvini Miller, 1883. Cat. Amer. Pal. Foss., 2d ed., p. 298.

The author describes this species as follows:

"Shell small, concavo-convex, quadrate in outline. Cardinal extremities sometimes abruptly produced, sometimes rounded. Ventral valve very convex, flattened on the umbo and descending rapidly to the lateral and frontal margins. Dorsal valve concave, following closely the curvature of the other. Hinge area common to both valves, wider on ventral, finely striated. Foramen only sufficiently developed to receive the extremities of the bifid cardinal process. Muscular scars faintly impressed, not definitely bounded.

"Surface of ventral valve ornamented by fine radiating striæ. From three to five very small striæ are implanted between pairs of more prominent, but very slender, filiform, and often slightly interrupted ones. A broad, shallow mesial sinus sometimes occupies the front half of the valve. On the dorsal valve the striæ are subequal, corresponding to the finer ones of the ventral valve.

"Length, 9^{mm}; width, 11^{mm}; convexity, 5^{mm}."

The species occurs in the Devonian formation of Iowa and corresponds, from the description, very closely with the Nevada form. The latter is proportionally a little broader and slightly convex on the umbo, but does not appear to differ specifically.

Formation and localities.—Lower horizon of the Devonian limestone, Lone Mountain, 18 miles northwest of Eureka, and Comb's Peak, Eureka District, Nevada.

Genus CHONETES Fischer.

It is difficult to determine the specific relations of many of the forms of the Productidæ and especially those belonging to the genus Chonetes, as the shells are usually small and depend largely on the surface characters and the presence of the cardinal spines for their specific determination.

These features are usually more or less obscured by the complete or partial exfoliation of the shell, even if it has escaped being worn or macerated previous to being embedded in the sediment. The varying conditions of preservation, if in a pure limestone, calcareous or argillaceous shale, or in an arenaceous rock, also materially complicate the question of the identity of species from various horizons and widely separated localities. The identifications between the Nevada and New York specimens of the same species were made with the above conditions in view and on a direct comparison with authentic specimens in the Hall collection at the American Museum of Natural History in New York City, most of which were used in the original diagnoses of the various species.

Chonetes hemispherica Hall.

Chonetes hemispherica Hall, 1857. Tenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 116,
and Pal. N. Y., vol. iv, p. 118, pl. xx, fig. 6, 1867.
· *hemispherica* Billings, 1861. Can. Jour., vol. vi, p. 349.
Nicholson, 1873. Pal. Prov. Ontario, p. 75.
Compare *Strophomena gibbosa* Conrad.

The types of this species are from the Schoharie grit and Corniferous limestone of the Upper Helderberg Group of New York. It is a strongly marked form, and with the exception of the closely allied *C. arcuata*, from the Corniferous limestone, it is not likely to be confused with any other species from the Devonian. The Nevada specimens have the same ventricose or subhemispheric ventral valve, with its prominent umbo rising above the hinge line. The surface is largely exfoliated from all the specimens in the collection, but sufficient remains to exhibit the characteristic radiating striæ. As far as yet known it is confined to the Lower Devonian, and is associated with other well-defined Upper Helderberg forms, viz: *Productus* (*P.*) *navicellus*, *P.* (*P.*) *truncatus*, *Spirifera raricosta*, etc.

Among the collections of the Fortieth Parallel Exploring Expedition there is a specimen of this species from the summit of Cave Cañon, Piñon Mountains, Nevada.

Formation and locality.—Lower horizon of the Devonian limestone, Lone Mountain, 18 miles northwest of Eureka, Nevada.

Chonetes deflecta Hall.

Plate ii, figs. 8, 8 *a*, *b*.

Chonetes deflecta Hall, 1857. Tenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 149.
gibbosa Hall, 1857. *Ibid.*, p. 145.
deflecta Hall, 1867. Pal. N. Y., vol. iv, p. 126, pl. xxi, figs. 7 *a–g*, 8 *a–c*.

The shells referred to this species are from the Upper and Lower Devonian beds, and in size, general form, convexity and surface markings are specifically identical with the examples of the species from the Hamilton Group of New York. There is considerable difference in the height and width of different shells, and also in the strength of the radiating surface striæ. In the latter variation *Chonetes acutiradiata* Hall is directly connected with *C. deflecta*, as expressed in its more transverse forms. Some of the more coarsely striated examples approach *C. mucronata*, but not sufficiently so to be identified with that species.

Its vertical range is from the Lower Devonian = Upper Helderberg Group of New York, to the Upper Devonian = Chemung Group of New York.

Formation and localities.—Lower horizon of the Devonian limestone, Comb's Peak, west slope of County Peak, and lower beds at Lone Mountain, 18 miles northwest of Eureka, Upper Devonian of Rescue Hill, Eureka District, Nevada.

Chonetes mucronata Hall?

Strophomena mucronata Hall, 1843. Geol. Rep. Fourth District New York, p 181 and p. 180, fig. 3.
Chonetes laticosta Hall, 1857. Tenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 119.
mucronata Hall, 1867. Pal. N. Y., vol. iv, p. 124, pls. xx, xxi.
Nicholson, 1873. Pal. Prov. Ontario, p. 74.

Professor Hall gave the specific designation *C. laticosta* to a small, gibbous, coarsely striated shell from the Upper Helderberg and Hamilton Groups of New York, which he subsequently considered as a variety of *Chonetes mucronata*. With this form the Nevada specimens are identified, as none of the larger, more finely striated examples are yet known from the Rocky Mountain area.

The largest specimens from Nevada have a length of 4^{mm}, and a width of 6^{mm}, the ventral valve being strongly convex or gibbous and marked by from eighteen to twenty-two strong striæ. There is only one cardinal spine preserved; this is bent down and directed outward subparallel to the cardinal margin.

The specific identification is made with hesitation, as the specimens are somewhat imperfect, and the large adult shells are not present in the collections from Eureka; still the facts in favor of the identification appear to be much stronger than those against it.

Formation and locality.—In the upper beds of the Devonian limestone of the foothills east of Sentinel Mountain and the Sugar Loaf, Eureka District, Nevada.

Chonetes setigera Hall.

Strophomena setigera Hall, 1843. Geol. Rep. Fourth District of New York, p. 180, fig. 2.
Chonetes setigera Hall, 1857. Tenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 150. Hall, 1867. Pal. N. Y., vol. iv, p. 129, pl. xxi, fig. 2; pl. xxii, figs. 1–5.

This species is associated with the preceding in the same hand specimens of limestone. Of its occurrence in the Marcellus shale, Professor Hall says: "This species occurs in the same black shale with *C. mucronata*, and may be distinguished from it by the more numerous and more frequently bifurcating striæ, which are likewise more angular. The direction of the cardinal spines, when present, is always a characteristic feature."

This comparison is equally accurate when applied to the Nevada specimens, as the specific characters are similar in the eastern and western shells. Professor Hall gives Meadville, Pennsylvania, as the locality where it is found in the Chemung Group, thus showing its range upward from the base of the Hamilton Group. As far as known, it occurs only in the upper beds of the Devonian, in the Eureka District.

Formation and locality.—In the upper beds of the Devonian limestone of the foothills east of Sentinel Mountain and the Sugar Loaf, Eureka District, Nevada.

Chonetes macrostriata, n. sp.

Plate ii, fig. 13; pl. xiii, figs. 14, 14*a–c*.

Shell varying in form from tranverse, subelliptical, length and breadth as 2 to 3, to subsemicircular, the length and breadth as 3.5 to 4. Hinge-line a little shorter than the greatest width, in both young and old shells. Cardinal angles obtuse.

Ventral valve varying from moderately convex, in young shells, to very convex or gibbose in the older ones. This difference in convexity is also shown in older shells of the same general size, the more narrow individuals being much more convex. The outline of the valve presents the greatest convexity on the umbo, the curvature to the front and lateral margins being regular, while it is more rapidly depressed towards the somewhat flattened cardinal extremities; a feature noticeable in the younger shells and strongly developed in the adults. Dorsal valve more or less conformable in curvature to the opposite valve.

Surface marked by strong, rounded striæ, the spaces between them being less than their width. They increase by intercalation and bifurcation, a shell 15^{mm} in breadth having twenty on the lower part, and one 40^{mm} broad forty, the striæ on each having slight undulations in their course. No traces of concentric striæ are to be seen.

The cardinal margin of the ventral valve in the younger shells shows five or six small oblique spines on each side of the apex that in the older shells are not visible in any specimens in the collection. The ventral area is narrow, linear, and has a rather small foramen midway that is partially closed by the cardinal process of the opposite valve. Dorsal area very narrow.

The imperfect cast of the ventral valve shows a bilobed apex, formed by the diverging dental lamellæ and narrow median ridge, the muscular impressions being obscured by adhering fragments of the shell. The portions of the surface of the interior of this and the dorsal valve that are shown in the specimens are finely papillose, the papillæ of the dorsal valve being somewhat coarser than those of the ventral.

The variation between the young and adult individuals of this species is so great that the two extremes will readily be taken as distinct species, to avoid which an illustration is given of the younger and older shells with an intermediate form. The outer surface of the ventral valve of the shell is exfoliated, the characteristic striæ showing on the dorsal valve of the same specimens.

Formation and localities.—Lower horizon of the Devonian limestone, Comb's Peak; south spur of Atrypa Peak; on the divide of the Reese and Berry Cañon, and midway of Gray's Cañon, Eureka District, Nevada; also at the same horizon at the north end of the Ravens Nest, Piñon Range, Nevada.

Chonetes filistriata, n. sp.

Plate xiii, figs. 15, 15*a*.

Shell transverse, broadly subelliptical, varying in proportion from 4 to 3, to 3 to 2, in breadth and length, respectively; the hinge-line is a trifle shorter than the greatest width of the shell, and the cardinal angles are extended in very short auriculate points.

Ventral valve moderately convex, the convexity varying but slightly between the young and old shells; the outline of the valve is regularly convex, rising from the cardinal margin and sloping more rapidly from the broad central portion towards the front and lateral margins; cardinal margin with three or more short, slightly oblique spines on each side of the apex. The area is narrow, linear, and divided midway by a rather broad triangular foramen that is nearly filled by the cardinal process of the opposite valve.

The dorsal valve is moderately concave, following very nearly the curvature of the ventral valve. Area linear and very narrow.

Surface marked by numerous fine, closely arranged striæ, that increase by intercalation and bifurcation; they extend to nearly the hinge line on the cardinal extremities, and vary in number from 80 to 90 on the lower portion of a medium-sized shell. A few specimens show faint undulating concentric striæ.

The specimens are all preserved in a shaly limestone and the interiors of the valves have not been observed.

Numerous shells corresponding in general form and size with this species occur at the same locality a few feet higher in the strata. Their surface, however, is smooth, or shows traces of very fine striæ, a feature produced probably by maceration or the smoothing of the shell by attrition during the life of the animal.

Of the Devonian species of Chonetes from the Devonian of the Mississippi Basin or New York, *C. coronata* Conrad (See Pal. N. Y., vol. iv, p. 133), is most nearly related to this in general form. It differs materially in the coarser surface markings, more oblique cardinal spines, smaller ventral foramen, and greater convexity.

Formation and locality.—Lower horizon of the Devonian limestone, Comb's Peak, Eureka District, Nevada.

Genus PRODUCTUS Sowerby.

Subgenus PRODUCTELLA Hall, 1867.

Productus (Productella) subaculeatus Murch.

Plate vii, fig. 2, pl. xiii, figs. 19, 19*a*, 20, 20*a*.

For list of synonyms see Davidson's Monograph of British Devonian Brachiopoda, p. 99, and Pal. N. Y., vol. iv, p. 154.

The figures given by Murchison of the type of this species[10] might have been taken from specimens from the Eureka District, so close is the similarity between the forms from the two widely separated localities. There are some slight variations in larger specimens but hardly sufficient to indicate a varietal distinction in a species of a genus subject to so many and wide departures from what may be considered the types of some of its most typical species.

The illustrations given in the fourth volume of the Paleontology of New York, plate xxiii, are of smaller shells than those from Nevada, but appear to be specifically identical with them, while the four referred to this species, with a query, from the Devonian limestone of Nevada (Geol. Expl. Fortieth Parallel, vol. iv, p. 36), are evidently referable to a variety of Hall's *P.* (*P.*) *Shumardianus*.

Professor Hall identifies *P.* (*P.*) *subaculeatus* in the Upper Helderberg limestone, and states that he does not know of its occurrence in the Hamilton and Chemung Groups of New York.

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[10] Bull. de la Soc. Geol. de France, vol. xi, p. 255, pl. ii, figs. 9*a*, *b*, *c*.

In Europe it has a wide vertical range in the Devonian formation, and its geographic range is very great.

There appears to be considerable confusion in regard to the relations of this species and *P.* (*P.*) *Shumardianus* of Hall, and also with several European forms that have been identified with it. There can hardly be any doubt of the identity of the specimen figured on plate xiii, figs. 20, 20*a*, the one given by Murchison in his original description of the species, and the adjoining figures, 19, 19*a*, of the Nevada specimen which is associated in the same layer of rock with specimens which unite it, by a series of examples, with the typical forms of *P.* (*P.*) *Shumardianus* as they occur in the Burlington sandstone of Iowa. At present it is not practicable to give the necessary illustrations to show the passage from this species to several forms now considered as distinct, but it is anticipated that the opportunity will be afforded in the future and that larger collections will be accessible from the Devonian of the Rocky Mountain region.

Formation and localities.—Lower, middle, and upper horizons of the Devonian limestone, west slope of County Peak; Rescue Hill; mouth of Packer Basin, and at The Gate northwest of Eureka, Eureka District, Nevada.

Productus (*P.*) *subaculeatus* also occurs in the Lower Carboniferous of the Eureka District.

Productus (Productella) Shumardianus Hall.

Plate xiv, fig. 1.

Productus shumardianus Hall, 1858. Geol. Rep. Iowa, vol. i, pt. 2, p. 499, pl. iii, fig. 9; pl. vii, fig. 1.
spinulicostæ (in part) Hall, 1857. Tenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 173.
concentricus Hall, 1857. Tenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 180; Geol. Rep. Iowa, vol. i, pt. 2, p. 517, pl. vii, fig. 3.
pyxidatus (partim vel totum) Hall, 1858. Geol. Rep. Iowa, vol. i, pt. 2, p. 498, pl. 3, figs. 8*a–e*.
Productella shumardiana Hall, 1867. Pal. N. Y., vol. iv, p. 157, pl. xxiii, figs. 6–8.

With the views expressed in relation to this species, in the remarks on *P.* (*P.*) *subaculeatus*, it is unnecessary to state why they are considered as closely allied and probably identical species. This form ranges throughout the Devonian limestone of the district and occurs in the lower beds at Lone Mountain, 18 miles northwest of Eureka.

The variety *P.* (*P.*) *pyxidatus* is found in both the lower and upper beds. It does not appear to be specifically distinct from the form referred to *P.* (*P.*) *Shumardianus*.

Productus (Productella) Hallanus, n. sp.

Plate xiii, figs. 17, 17*a*.

Productus dissimilis Hall, 1858. Geol. Rep. Iowa, vol. i, pt. 2, p. 497, pl. iii, figs. 7*a–e*.
dissimilis Meek, 1868. Trans. Chicago Acad. Sci., vol. i, p. 91, pl. xiii, fig. 3.
Not *Productus dissimilis* De Koninck, 1846.

Shell semielliptical or suborbicular, with the length and breadth usually nearly equal, although in some instances it is transversely elliptical. Hinge line shorter than the greatest width of the shell

Ventral valve strongly convex, ventricose on the upper part, which projects slightly over the hinge line at the umbo and terminates in a slightly incurved beak; the sides are a little depressed towards the somewhat auriculate cardinal extremities. Area extremely narrow and rarely seen even on well preserved shells. Dorsal valve concave, following the curvature of the opposite valve.

Surface of ventral valve marked by fine radiating striæ that are slightly irregular in their course, as if deflected by the few scattered, scarcely perceptible spine bases. The dorsal valve shows no radiating striæ, but strong subimbricating, concentric lines give a striking appearance in constrast with the radiating striæ of the ventral valve.

The type specimens of Professor Hall's *P.* (*P.*) *dissimilis* were from the Hamilton Group, at or near Rockford, Iowa, and present all the characters mentioned in the above description, which was drawn from the Nevada specimens. The specific identity of the two forms is very close, and does not permit of a separation on any differences presented by the specimens now before me. As the name given by Professor Hall was preoccupied by a species of the same generic relations from the Devonian rocks of Belgium, a new specific designation is given in honor of the original discoverer of the species

Formation and localities.—Lower and upper horizons of the Devonian limestone, west slope of County Peak, and Rescue Hill, Eureka District, Nevada.

Productus (Productella) navicella Hall.

Plate xiii, fig. 9.

Productus navicella Hall, 1857. Tenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 172.
Productella navicella Hall, 1867. Pal. N. Y., vol. iv, p. 156, pl. xxiii, figs. 1–3, 9–11.

The specimens referred to this species from the Upper Helderberg and Hamilton Groups of New York are distinguished by their narrow, elongate form, extreme arcuation, and strong costæ on the lower half of the shell that are extended upward as little ridges formed by the spine bases. The specimens representing the species in Nevada are a little more elongate than the average of the New York forms, and the radiating costæ are somewhat stronger, otherwise the two are identical.

Formation and locality.—Lower horizon of the Devonian limestone, south ridge of Atrypa Peak, Eureka District, Nevada.

Productus (Productella) truncatus Hall.

Plate xiv, fig. 2.

Productus truncatus Hall, 1857. Tenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 171.
Strophomena pustulosa Hall, 1843. Geol. Rep. Fourth District New York, p. 18.
Productella truncata Hall, 1867. Pal. N. Y., vol. iv, p. 160, pl. xxiii, figs.12–24.
Not *Productus pustulosus* Phillips.

This pretty little species occurs in the Lower Devonian beds, and presents the characters of the specimens from the Marcellus shale of New York.

In his remarks on this species, Professor Hall states that, on the authority of M. de Verneuil, *Strophomena pustulosa*, a species founded apparently on a dorsal valve of this species, has been referred to *Productus* (*Strophalosia*) *Murchisonianus* M. de Koninck, which is likewise regarded as identical with the species Professor Hall described as *Productus Shumardianus*. Professor Hall has shown that *P.* (*P.*) *truncatus* possesses features not observed in *P.* (*P.*) *Shumardianus*, and, as it occurs in Nevada, it is very distinct from the young shells of the latter species. It approaches much more nearly *P.* (*P.*) *navicella*, with which it is associated, differing from that very decidedly in its truncated apex, much less arcuate ventral valve, and broader, less elongate outline. With *Productus Murchisonianus* it appears to present but very few characters in common.

Formation and localities.—Lower horizon of the Devonian limestone, south ridge of Atrypa Peak, and west slope of County Peak, Eureka District, Nevada.

Productus (Productella) lachrymosus var. **limus** Conrad (Sp.).

Plate xiii, figs. 18, 18*a*.

Strophomena lima Conrad, 1842. Jour. Acad. Nat. Sci. Philad., vol. viii, p. 256.
Productella lachrymosa var. *lima* Hall, 1867. Pal. N. Y., vol. iv, p. 174, pl. xxv, figs. 29–32.

This variety of *P.* (*P.*) *lachrymosus* is well represented by specimens from the summit of the Devonian limestone at The Gate, where it is associated with *P.* (*P.*) *subaculeatus* and *P.* (*P.*) *lachrymosus* var. *stigmatus*. The median depression of the ventral valve and the characters of the spiniferous tubercles are distinctly marked, as also the general form and size of the shell.

Formation and locality.—Devonian limestone, at The Gate, northwest of Eureka, Nevada.

Productus (Productella) lachrymosus, var. stigmatus Hall.

Productella lachrymosa var. *stigmata* Hall, 1867. Pal. N. Y., vol. iv, p. 174, pl. xxv, figs. 33–41.
Compare *Productus?* Meek, 1868. Trans. Chicago Acad. Sci., p. 92, pl. xiii, fig. 5.

This strongly marked variety is represented by a fine series of specimens that present it as found in the Chemung Group of New York and also pass towards a more costate variety that, in this respect, draws near the true species *P.* (*P.*) *lachrymosus*, but in size and general appearance it is more nearly related to the var. *stigmatus*. The costæ or plications are not formed by the elongation of the spine bases but by the plication of the shell, and present various stages of development, from a simple trace on the front margin to where they pass up over the center.

The form from the Mackenzie River Basin, illustrated by Mr. Meek and not specifically identified, is very closely related to the semicostate variety, if not identical with it, and it occurs in association with *Rhynchonella castanea*, a form found with *P.* (*P.*) *lachrymosus* var. *stigmatus*, at Rescue Hill.

Formation and localities.—Upper horizon of the Devonian limestone, Rescue Hill, and The Gate, northwest of Eureka, Nevada.

Productus (Productella) speciosus Hall.

Plate xiii, fig. 8.

Productus speciosus Hall, 1857. Tenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 176.
Productella speciosa Hall, 1867. Pal. N. Y., vol. iv, p. 175, pl. xxv, figs. 1–11.

This beautifully marked species occurs in the same beds with the varieties of *P.* (*P.*) *lachrymosa*, but it is so distinctly characterized by a narrow, somewhat attenuate umbo and the closely arranged smaller and more numerous spiniferous tubercles that there is little danger of confounding the two species. Of the identity of the New York Chemung Group specimens and those from the Eureka District there is hardly an opportunity to suggest a point in opposition, as they closely coincide in all their specific characters.

Formation and localities.—Upper horizon of the Devonian limestone, Rescue Hill, and at The Gate, northwest of Eureka, Nevada.

Productus hirsutiforme, n. sp.

Plate ii, figs. 10, 10 *a*.

Shell thin, transversely semicircular; width less than the length, unless distorted by compression; hinge line equaling or a little less than the width of the shell.

Ventral valve moderately convex and without median sinus, rather abruptly depressed toward the cardino-lateral margins, which are flattened and broadly auriculate; beak small, incurved. Dorsal valve concave and following the curvature of the ventral one.

Surface marked by closely arranged, slightly undulating, concentric striæ and slight undulating ridges of growth in some examples. A few slender curved spines are scattered irregularly over the surface.

The interior of the ventral valve is minutely papillose throughout; other interior characters unknown.

It is with hesitation that a new specific name is given to a species of this genus, owing to the range of specific variation within it. As indicated by the name, the species is related to *P. hirsuta* Hall of the Chemung Group of New York. It differs in the surface characters. It has a few minute scattered spines on a comparatively smooth surface, while *P. hirsuta* has fine spines with elongate bases over the entire surface, and also a row of long spines near the cardinal border.

Formation and localities.—Upper Devonian, White Pine shale, on the south slope of Diamond Peak, Eureka District, and also at the same geologic horizon throughout the shale on the east side of Applegate Cañon, White Pine Mining District, Nevada.

Genus SPIRIFERA Sowerby.

Spirifera disjuncta Sowerby, 1840.

Synonyms: See Davidson's Monograph of British Devonian Brachiopoda, and Paleontology of New York, vol. iv, p. 243. To this there may be added:
Spirifera Norwoodi Meek, 1860. Proc. Acad. Nat. Sci. Philad., vol. xii, p. 308 (not *S. Norwoodi* Hall).
Utahensis Meek, 1860. Note appended to extra copies of above cited paper.
Kennicotti Meek, 1868. Trans. Chicago Acad. Nat. Sci., vol. i, p. 101, pl. xiv, fig. 9.
Utahensis Meek, 1876. Rep. Expl. Great Basin of Utah, Simpson, p. 345, and Geol. Expl. Fortieth Par., 1877, vol. iv, p. 39, pl. iii, figs. 1*a–e*.

The types of Mr. Meek's *Spirifera Utahensis* were collected at The Gate, northwest of Eureka, and cited as coming from a dark limestone of Devonian age, in longitude 115° 26′ W., latitude 39° 30′ N., a locality named Swallow Cañon by Captain Simpson, and now known as The Gate. From this locality a number of very perfect specimens were obtained by the Eureka Survey. They exhibit the narrow, rotund form, and also the short form with extended lateral angles. The examples of the species used by Mr. Meek were small, but do not differ from specimens of the same size found at Newark Mountain or specifically from the larger shells that are identical with examples of the species found in New York and also in England.

Formation and localities.—Central and upper portions of the Devonian limestone, Newark Mountain, and at The Gate, northwest of Eureka, Nevada.

Spirifera raricosta Conrad (Sp.).

Plate iv, figs. 2, 2*a*; pl. xiv, fig. 12.

Delthyris raricosta Conrad, 1842. Jour. Acad. Nat. Sci. Philad., vol. viii, p. 262, pl. xiv, fig. 18.
undulatus Vanuxem, 1842. Geol. Rep. Third District New York, p. 132, fig. 3.
Spirifera raricosta Billings, 1861. Can. Jour., vol. vi, p. 258, figs. 71–73 of p. 259; Pal. Fossils, 1874, vol. ii, pt. 1, p. 47, pl. 3 A, figs. 5, 5 *a*, *b*.
Hall, 1867. Pal. New York, vol. iv, p. 192, pl. xxvii, figs. 30–34, pl. xxx, figs. 1–9.
Nicholson, 1873. Pal. Prov. Ontario, p. 82.

A species closely allied to this, if not identical, occurs in the lower fossiliferous horizon of the Devonian limestone. It differs in not having quite as distinct concentric striæ, and also in the absence of the prominent septum shown in casts of the ventral valve of specimens from the Schoharie grit of New York. These are characters that are variable in the New York forms, and do not afford data for the establishment of a distinct species on the examples thus far obtained in Nevada.

At the East this species ranges through the Schoharie grit and Corniferous limestone of the Upper Helderberg Group, and its known geographical extension carries it west from New York across the State of Ohio to Southern Indiana and northwest into Canada West.

A larger series of specimens from Lone Mountain, collected a year after the above was written, show a gradation in form from *Spirifera raricosta* to *S. duodenaria*, the constant differences in the median sinus and fold alone serving to distinguish, in external characters, the two species.

Formation and localities.—Lower horizon of the Devonian limestone, Comb's Peak, Eureka District, and Lone Mountain, 18 miles northwest of Eureka, Nevada.

Spirifera varicosa Hall.

Spirifer varicosus Hall, 1857. Tenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 130.
Ibid., Description of New Pal. Fossils, p. 90, 1857.
Spirifera varicosa Hall, 1867. Pal. New York, vol. iv, p. 205, pl. xxxi, figs. 1-4.

Ventral valve transverse, semielliptical; length less than one-half the width, lateral extremities pointed; strongly convex, most prominent on the umbo; mesial sinus strongly defined, rounded on the bottom and continued to the apex of the beak; beak narrow and slightly incurved. Area equal to one-half the width of the valve; it is flat below and a little concave towards the apex; the fissure is high and large.

Surface marked by eight or nine simple, slightly angular plications on each side of the mesial sinus, and with fine radiating striæ near the umbo, where the only fragment of the outer surface is preserved, the remaining portions having been entirely exfoliated; traces of strong concentric striæ, however, are seen on the lower part of the cast.

The species represented by this single valve, is a member of a group of species illustrated by *Spirifera varicosa*, *S. segmenta*, and *S. arctisegmenta*, in the Upper Helderberg limestones of the Falls of the Ohio, and in New York State. It is related to *S. varicosa* by the general form, the size of the area and foramen, and the number of surface plications, and also the fine radiating striæ near the umbo; but, in the absence of the strong varicose concentric striæ, a striking difference exists between them. In the character of the plications the agreement is with *S. arctisegmenta*, but the latter has a very narrow foramen and the area bending forward, features that lead to making a provisional reference to the former species, as they are considered as of more importance than the development of the surface striæ; besides the Nevada shell shows traces of strong concentric striæ on the cast, and a large series of specimens would probably exhibit considerable variation in this respect. In this event, or should it prove to be a distinct species, it adds another member, by its general character, to the group of forms uniting the fauna of the Lower Devonian of Nevada and that of the Upper Helderberg Group east of the Rocky Mountain region.

Formation and locality.—Lower portion of the Devonian limestone, at Lone Mountain, 18 miles northwest of Eureka, Nevada.

Spirifera Parryana Hall?

Plate xiv, fig. 10.

Spirifer parryanus Hall, 1858. Geology of Iowa, vol. i, pt. 2, p. 509, pl. iv, figs. 8 *a*, *b*.
Parryana Billings, 1861. Can. Jour., vol. vi, p. 261, figs. 77, 78.

The original type of this species is from the Hamilton Group of Iowa. In all essential specific characters the ventral valve of the Nevada shell, the only portion discovered, is similar to that of the Iowa type, differing mainly in the absence of the fine concentric striæ crossing the radiating striæ. Each of these features, the simple radiating striæ and the concentric striæ, occur on different specimens of an allied species, *S. mesastrialis*, of the Chemung Group of New York. The finding of entire shells may afford specific distinctions not known at present, but with the present specimens, the identification is made with *S. Parryana.*

A specimen collected by the geologists of the Fortieth Parallel Geological Survey, labeled "Piñon Range," is larger than the Eureka specimens, but otherwise agrees with the specimen illustrated.

Formation and locality.—Devonian limestone, on the divide at the head of the Reese and Berry Cañon, Eureka District, Nevada.

Spirifera (sp. und't.).

This species is allied to the group represented by *Spirifera Manni*, of the Upper Helderberg Group of New York and Ohio. The ventral valve is subpyramidal, the height nearly equaling one-half the length. Apex slightly projecting over the area. Mesial sinus well-defined, reaching to the apex. Area elevated, slightly concave above; fissure open to the apex, about twice as long on the sides as the width at the base.

Surface marked by six or seven subangular or rounded plications on each side of the median sinus. Finer surface markings unknown, owing to the exfoliation of the shell.

Owing to the fact that species of this genus undergo great variations, and that our material is unsatisfactory, no specific reference is made of this shell.

Formation and localities.—Devonian limestone, Comb's Peak, Eureka District, and Lone Mountain, 18 miles northwest of Eureka, Nevada.

Spirifera Englemanni Meek.

Spirifera Englemanni Meek, 1860. Proc. Acad. Nat. Sci. Philad., vol. xii, p. 308.
Meek, 1876. Rep. Expl. Great Basin of Utah (Simpson), p. 346, pl. i, figs. 1 *a–c*. (Not *S. Englemanni*, M. & W.)
Meek, 1877. Rep. Geol. Expl. Fortieth Par., vol. iv, p. 41, pl. iii, figs. 3 *a–e*.

The original specimens of this species were found at The Gate, northwest of Eureka, by Colonel Simpson's exploring party, and subsequently Mr. Arnold Hague obtained examples from the White Pine Mountains southeast of the Eureka District.

The specimens in the present collection came from Newark Mountain, in the upper portion of the Devonian limestone, and present the essential characters given by Mr. Meek in his description of the species.

Spirifera Pinonensis Meek.

Plate iv, figs. 1, 1 *a–f*.

Spirifer (*Trigonotreta*) *Pinonensis* Meek, 1870. Proc. Acad. Nat. Sci. Philad., vol. xxii, p. 60. *Ibid.*, 1877, Geol. Expl. Fortieth Par., vol. iv, p. 45, pl. i, figs. 9 *a*, *b*.
Spirifera (*Trigonotreta*) *argentarius* Meek, 1877. Geol. Expl. Fortieth Par., vol. iv, p. 42, pl. iv, figs. 4 *a–b*.

This species ranges from the base to the summit of the Devonian limestone, throughout the Eureka District, and also occurs in the Piñon Mountains, where the original types described by Mr. Meek were collected. In the White Pine Mountains the variety described as *S.* (*T.*) *argentarius* Meek is found in the Middle and Upper Devonian. The species *S. Pinonensis* was founded on the larger, more coarsely ribbed variety. Among the large series collected in the Piñon Range a shading off into the smaller, finer ribbed form is observed, and among the still more extensive series from the Eureka District the gradation of form and characters between the type of *S. Pinonensis* and *P. argentarius* is complete.

Formation and localities.—The species ranges throughout the Devonian limestone, having been found in the upper beds south of The Gate and at Newark Mountain; at the lower horizon it occurs at Comb's Peak; Atrypa Peak; Lone Mountain, 18 miles northwest of Eureka, etc., Eureka District; also at the west base of Mount Argyle, White Pine District, Nevada.

Subgenus MARTINIA McCoy.

Spirifera (Martinia) glabra Martin.

For list of synonyms, see British Carboniferous Brachiopoda, Davidson, vol. ii, p. 59.

Spirifera M. glabra is mentioned by Mr. Davidson in his monograph of the British Carboniferous Brachiopoda, p. 62, as occurring in Devonian rocks, and he also states that he had specimens from the Devonian of Devonshire which appeared undistinguishable from those in the Carboniferous limestone. Before reading this observation we had compared the Devonian specimens from Nevada with examples of *S.* (*M.*) *glabra* from the Carboniferous limestone of England, and also with Mr. Davidson's beautiful illustrations of the species, and concluded that they were at the most but a variety of the same species, and it is only for convenience in referring to the Nevada Devonian form that a varietal name is proposed.

Spirifera (*M.*) *Franklini* Meek, 1869 (Trans. Chicago Acad. Sci., vol. i, p. 107, pl. xiv, fig. 12), is, as mentioned by Mr. Meek, closely related to *S.* (*M.*) *glabra*, and with the original specimen before me to compare with the Nevada shells and Mr. Davidson's figures of the species, it scarcely appears to be more than a variety, if even that, of *S.* (*M.*) *glabra*. Mr. Meek separated it from *S.* (*M.*)*glabra* on account of having the lateral margins of the area of the ventral valve extending out part way parallel to the hinge margins, instead of sloping regularly from the beak to the extremities of the hinge. In the variety to be next described both characters occur on the area of the ventral valve on different specimens, so that it is scarcely a good specific distinction.

Spirifera (M.) glabra, var. Nevadensis, n. var.

Plate iii, fig. 5; pl. xiv, figs. 14, 14 *a*, *b*.

The range of variation among the specimens in the collection is considerable, as they differ in the strength and angularity of the mesial fold and sinus, and the depression along the middle of the mesial fold of the dorsal valve may be strong as in the example illustrated on plate xiv, fig. 14, or entirely absent even in large-sized specimens. Some shells are also much more transverse than others and the relative length of the hinge line varies.

The surface is usually smooth, owing to the condition of preservation of the shell. Examples show, however, that it was marked in some instances by obscure radiating plications, concentric striæ about 1^{mm} distant, also fine radiating interrupted striæ. These vary in different shells and in some are entirely absent.

The variety differs from the typical specimens of *S.* (*M.*) *glabra* in having the greatest transverse diameter higher up on the shell, and the mesial fold and sulcus usually more angular. It also averages smaller in size, the largest specimen having a height of 30^{mm}, with a breadth of 38^{mm}, and the average about 25^{mm} by 30^{mm}.

Professor Hall compares *S.* (*M.*) *glabra* and *S.* (*M.*) *lævis* of the Devonian of New York, and more recently the latter has been considered a variety of *S.* (*M.*) *glabra*,[11] a reference that I would concur in, placing it, the Nevada variety, and Mr. Meek's *S.* (*M.*) *Franklini*, from British America, as the three known representatives of the Carboniferous species in the Devonian rocks of the eastern and western side of the continent.

Formation and localities.—Upper portion of the Devonian limestone, on the ridge east of Yahoo Cañon, and on the south side of The Gate, northwest of Eureka, Eureka District, Nevada.

The above was written in 1881, as the result of the study of the specimens then in the collection. In the summer of 1882 I returned to the locality and obtained a number of good specimens, some of which have faintly defined radiating plications, thus showing that those represented on fig. 14 *b*, plate xiv, were not the result of irregular exfoliation of the outer shell, but a portion of the original surface. An additional figure, plate iii, fig. 5, is given of a less transverse specimen than that represented on plate xiv, figs. 14, 14 *a*, *b*. This is of the same character as that of *S.* (*M.*) *undifera*, from the Lower Devonian, plate iii,, figs. 6, 6 *a*. The relations of *S.* (*M.*) *glabra* and *S.* (*M.*) *undifera* will be spoken of in the description of the latter species.

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[11] H. S. Williams' Life History of *Spirifera lævis*, Ann. New York Acad. Sciences, vol. ii, 1881.

Spirifera (M.) Maia Billings.

Plate iii, figs. 1, 1 *a–e;* pl. xiv, figs. 13, 13*a*.

Athyris Maia Billings, 1860. Can. Jour., vol. v, p. 276, figs. 33, 34.
Spirifera Maia Hall, 1867. Pal. New York, vol. iv., p. 416; pl. lxiii, figs. 6–13.
Athyris (?) Maia Nicholson, 1874. Pal. Prov. Ontario, p. 88.
Compare *Spirifera subumbona* Hall. 1867. Pal. N. Y., vol. iv, p. 234, pl. xxxiii, figs. 22–30. *S.* (*M.*)*meristoides* Meek, 1868. Trans. Chicago Acad. Sci., vol. i, p. 106, and *S.* (*M.*) *sublineatus* Meek, *ibid.* p. 103.

Professor Nicholson considers *Spirifera* (*M.*) *Maia*, as identified by Professor Hall as, probably, a distinct species from *Athyris Maia* Billings, and refers the Canadian species to the genus Athyris, with a query.

The specimens used by Professor Hall in his determination, three of which are illustrated on plate lxiii of vol. iv, Paleontology of New York, are now in the Hall collection in the American Museum of Natural History, New York City, and are from Saint Mary's, Canada West, the typical locality of the species. They exhibit the narrow cardinal area and small triangular fissure mentioned by Professor Hall, and also the variation in form from elongate to broad ovate. Mr. Billings and Professor Nicholson failed to observe the cardinal area and fissure which is frequently almost entirely concealed by the incurved beak..

The Nevada form corresponds with that from Canada West. Slight differences, liable to exist in specimens of the same species from widely separated localities, are not perceptible in the examples separated by an interval of nearly 1,800 miles, and there are no perceptible variations in form between the specimens occurring in the Lower Devonian horizon and those of the limestone beds over 3,000 feet above.

When comparing the adult shells with other species it is noticeable that the more transverse forms approach the type of *Spirifera* (*M.*) *lineata*, also the smooth variety of *Spirifera* (*M.*) *undifera.* If it were not for the large series of specimens it would not be difficult to select three allied species, but, with the intermediate forms, there is but one variable species which is closely allied to *Spirifera* (*M.*) *lineata* and *Spirifera* (*M.*) *planoconvexus* of the Carboniferous.

There is considerable variation of form among the large number of specimens representing the young of *S.* (*M.*) *Maia* in the collections from Rescue Hill and Sentinel Mountain. Those that are broader than long, with the beak a little incurved over the high, prominent area of the ventral valve, are essentially identical with the type specimens illustrated by Professor Hall (Pal. N. Y., vol. iv, pl. xxxiii, figs. 22–30) from the Hamilton Group of New York as *Spirifera* (*M.*) *subumbona.* Closely resembling these come the forms described by Mr. Meek from the Devonian limestone of the Mackenzie River Basin. As described by him and illustrated (Trans. Chicago Acad. Sci., pp. 103, 106, pl. xiv, figs. 1 *a–c* and 2 *a–c*), the two species *S.* (*M.*) *meristoides,* and *S.* (*M.*) *sublineatus,* appear to be identical with the New York and Nevada species. The muscular impression on the cast of the ventral valve shows the faint furrow in some specimens more deeply impressed, with the flat, shallow, lateral impressions, as in *S.* (*M.*) *sublineata,* and in other specimens the vascular impressions are shown, as in *S.* (*M.*) *meristoides,* and the form of *S.* (*M.*) *meristoides* is similar to that of a globose, elongate variety of *S.* (*M.*) *Maia,* that has the beak closely incurved. If the species are not the same they are at least very closely allied. The series of variations continue in the direction of a more elongate gibbous form, with the beak incurved over and partially concealing the low area; this feature also occurs in a broader gibbose variety, which is connected by a direct series of specimens with the Hamilton species *S.* (*M.*) *subumbona.* The latter, as it occurs in New York, is distinguished by the fine concentric striæ and minutely punctate surface, although the shell structure appears to be fibrous. The same surface and shell structure is shown in the young shells of *S.* (*M.*) *Maia.* At first these were separated and referred to *S.* (*M.*) *subumbona,* but the obtaining of a large number of specimens of various forms and size in association with *S.* (*M.*) *Maia* showed this separation to be a forced one. It is possible that *S.* (*M.*) *subumbona* is distinct from the young of *S.* (*M.*) *Maia,* and until the material can be obtained to show that in the eastern Devonian the young of *S.* (*M.*) *Maia* is identical with *S.* (*M.*) *subumbona,* the two specific names will have to be recognized.

Formation and localities.—Devonian limestone, Rescue Hill, south slope of Sentinel Mountain, west slope of County Peak, Eureka District and Lone Mountain, northwest of Eureka, Nevada.

Spirifera (M.) undifera Roemer.

Plate iii, figs. 3, 3 *a*, *b*, 6, 6 *a*; plate xiv, figs. 11, 11 *a*, *b*.

Spirifer undiferus Roemer, 1844. Rhein. Uebergangseb., p. 70 u. 73, tab. iv, figs. 5, 6.
undiferus Schnur, 1853. Dunker's Palæontographica, vol. iii, Brach., Eifel., p. 204, tab. xxxiv, figs. 3 *a–d*.
Sandberger, 1855. Brach., Rhein, Schichtensystems, p. 18, pl. xxxi, fig. 8.
Spirifera undifera Davidson, 1865. Mon. Brit. Devon. Brach., p. 36, pl. vii, figs. 1–10; also, var. *undulata*, ibid., figs. 11–14.
compactus Meek, 1868. Trans. Chicago Acad. Sci., vol. i, p. 102, pl. xiv, figs. 11 *a–d*.
undiferus, var. *Takwanensis*, Kayser, 1882. China, Richthofen, vol. iv, p. 86, tab. xi, figs. 1, 1 *a–e*.
Compare *Spirifera fimbriata* (Conrad, 1842) Hall, 1867. Pal. N. Y., vol. iv, p. 214, pl. 33; also, *S. subundiferus* M. & W., 1868. Geol. Surv. Illinois, vol. iii, p. 434, pl. x, figs. 5 *a–e*, and *S.* (*M.*) *Richardsoni* Meek, 1868. Trans. Chicago Acad. Sci., vol. i, p. 104.

But one specimen of this species was found among the Devonian Brachiopods brought from the Eureka District in 1880. That differed so much from a typical specimen of *Spirifera* (*M.*) *undifera*, kindly sent to me by Mr. Davidson, who received it from Dr. Roemer, that I gave it a specific name in manuscript, comparing it to *S.* (*M.*) *fimbriata* Conrad. During the field season of 1882 a large number of specimens were collected from the Lower Devonian of the same district that afford the means for a more extended comparison with *S.* (*M.*) *undifera* and *S.* (*M.*) *fimbriata*.

The variety shown by figs. 11, 11 *a–b*, of plate xiv (the original specimen found in 1880), has the beak of the ventral valve so closely incurved that the narrow area and the foramen are almost entirely concealed; the few broad, rounded plications are crossed by concentric striæ, with interspaces between of a little over one millimeter in width; on these, between the striæ, radiating interrupted striæ occur that are precisely similar to those on specimens of *S.* (*M.*) *fimbriata* Conrad, now before me, from the Upper Helderberg Group of New York, except that they are somewhat finer. On the shells of this species from the shales of the Hamilton Group these radiating striæ reach their maximum development, appearing as elongate, radiating tubercles on the interspaces between the imbricating striæ. Among the Eureka specimens individuals occur that show the concentric striæ about one-half a millimeter distant from each other, and others where they are crowded still more closely; in these we have the typical surface of *S.* (*M.*) *undifera*. This crowding together of the concentric striæ is carried still further in *S.* (*M.*) *compacta* Meek, where the radiating plications are also more numerous. No one can examine the beautiful series of forms given by Mr. Davidson on plate vii of his Monograph of Devonian Brachiopoda without observing that the range of variation in the strength and number of the plications is quite as great as between the Nevada type illustrated on plate xiv, and the British American form illustrated by Mr. Meek (Trans. Chicago Acad. Sci., vol. i, pl. xiv). The differences in the height of the area between the two last-mentioned shells is of a very decided character, but among the later collections examples occur that serve to bridge over and unite the two in this respect; one specimen has an area of the same height as the variety *S.* (*M.*) *compacta* (plate xiv, figs. 13 *b*, *c*), and another is intermediate (plate iii, fig. 5).

From Lone Mountain there is a shell of the type of *S. undifera* that has about twenty obscure plications on each side of the mesial fold and sinus of the ventral and dorsal valve, respectively. These are crossed by concentric striæ and fine radiating interrupted striæ. Still another specimen has lost all the radiating plications, and has only the concentric striæ and interrupted radiating striæ (plate iii, figs. 3, 3 *a*, *b*). The latter shell may readily be identified with *S.* (*M.*) *præmatura* Hall, of the Upper Devonian of New York, or *S.* (*M.*) *pseudolineata* or *S.* (*M.*) *setigera* of the Lower Carboniferous limestone of the Mississippi Valley. It is, however, in our opinion, a precursory type in the Lower Devonian of the shell we have called *S.* (*M.*) *glaber*, var. *Nevadensis* (*ante*, p. 139), and which, before the discovery of this shell without plications, in the Lower Devonian, was considered the direct lineal descendant of *S.* (*M.*) *undifera*. We cannot, however, fail to notice the close correspondence between the variety of *S.* (*M.*) *undifera* described by Mr. Meek as *S.* (*M.*) *compacta*, and the Carboniferous *S.* (*M.*) *pinguis* Sowerby, so fully illustrated by Mr. Davidson. *S.* (*M.*) *Richardsoni* Meek, from the Devonian of British America, is closely allied to the Lone Mountain shell having numerous radiating plications.

From these comparisons it appears that *S.* (*M.*) *undifera* is the type of a widely distributed and very variable species. Among the American varieties we place *S.* (*M.*) *fimbriata* Conrad, *S.* (*M.*) *subundifera* M. & W., *S.* (*M.*) *compacta* Meek, and the Nevada shell under consideration.

S. (*M.*) *undifera* and *curvatus*, var. *undulata*, Roemer, of the Middle Devonian of England and the continent of Europe, *S.* (*M.*) *erubescens* Eichwald (Leth. Ross, p. 703, taf. 34, fig. 18), *S.* (*M.*) *undifera*, var. *Takwanensis*, Kayser, from the Devonian of China, and *S.* (*M.*) *undifera* Ethridge, from Queensland, all appear to belong to the same specific group and show its wide geographic distribution.

It may be more convenient to use the older name *S.* (*M.*) *fimbriata* Conrad for the variety with the strong interrupted striæ, as it occurs in the Lower Devonian of New York and the Upper Mississippi Valley region, and Roemer's name *S.* (*M.*) *undifera* for the smoother, world-wide distributed variety so well illustrated by Davidson. If so, all the species mentioned will fall under *S.* (*M.*) *undifera* with the exception of *S.* (*M.*) *fimbriata*.

Professor Hall (Pal. N. Y., vol. iv, p. 216) calls attention to *S.* (*M.*) *setigera* and *S.* (*M.*) *pseudolineata* as representing in the Carboniferous limestone the type of *S.* (*M.*) *fimbriata*, and Mr. Davidson (Mon. Brit. Dev. Brach., p. 38) states that the resemblances between *S.* (*M.*) *undifera* and the Carboniferous *S.* (*M.*) *ovalis* and *S.* (*M.*) *pinguis* are often so striking as almost to lead one to believe that they are all mere modifications in shape of a single species.

We have called attention in describing *S.* (*M.*) *glaber*, var. *Nevadensis*, to Prof. H. S. Williams' life history of *S.* (*M.*) *lævis*=*glaber*, where he traces its descent from certain Upper Silurian forms through *S.* (*M.*) *fimbriata*, *S.* (*M*) *lævis*, *S.* (*M.*) *præmatura*, and considers *S.* (*M.*) *pseudolineata* as carrying on the type into the Carboniferous. This arrangement we have accepted, but the presence of the type of *S.* (*M.*) *pseudolineata* in the Lower Devonian suggests the view that the two types *S.* (*M.*) *undifera* and *S.* *glaber* were already differentiated in early Devonian times, and that the line of descent of *S.* (*M.*) *glaber* and *S.* (*M.*) *pinguis* and the group of species that each represent were determined in the Upper Silurian age. As we have no representations of the latter fauna in the West, further comparisons are omitted, the reader being referred to Professor Williams' excellent paper for his views of the Silurian representations of the type of Spirifera under consideration (Ann. New York Acad. Sci., vol. ii, 1881).

Spirifera (*M.*) *setigera* occurs in the Lower Carboniferous of the Eureka District, and thus gives a direct local continuation in the Carboniferous of the smooth shell, fig. 3, plate iii, from the base of the Devonian.

Formation and localities.—*Spirifera* (*M.*) *undifera* occurs in the Lower Devonian of Atrypa Peak in the Eureka District, and also at the same horizon on Lone Mountain, 18 miles northwest of Eureka, Nevada.

Genus CYRTINA Davidson.

Cyrtina Davidsoni, n. sp.

Plate iii, figs. 2, 2 *a–e*.

Shell small; general shape more or less triangular or subpyramidal; hinge line a little shorter than the greatest length of the shell.

Ventral valve pyramidal and very much deeper than the dorsal, most prominent at the beak, which varies in elevation and is straight or a little arched over the area; area large, triangular, flat or slightly arcuate, more or less angular on the lateral margins; bent back at varying angles to the general surface of the dorsal valve; fissure long, narrow, and apparently arched, nearly if not quite, over by the pseudo-deltidium; the median sinus is obsolete or else merely a depression between two low, rounded plications.

Dorsal valve semicircular or depressed convex; beak minute and rising a very little above the cardinal line; area linear, very narrow; medium fold obsolete or else a low, rounded plication similar to those on either side.

Surface marked by one or two rounded plications on each side of the medium sinus and fold, or these may be almost entirely absent, showing as slight undulations on the front margins of the valves. Shell structure punctate.

Dimensions: width of valves of largest example obtained, 8^{mm}; height of dorsal valve, 6^{mm}; depth of ventral valve, 5^{mm}.

This very pretty species of Cyrtina is unlike any known to me. The range of variation in the surface plications is considerable, but I do not think it would pass into such forms as *C. heteroclita*, a variety with few plications, or *C. Hamiltonensis*.

Formation and localities.—Middle and Upper Devonian limestone, Telegraph Peak, and eastern base of Mount Argyle, White Pine Mining District, Nevada.

Cyrtina Hamiltonensis Hall.

Cyrtia hamiltonensis Hall, 1857. Tenth Ann. Rep. N. Y. State Cab. Nat. Hist, p. 166.
Hamiltonensis Billings, 1861. Canadian Journal, n. ser., vol. vi, p. 262, figs. 80–82. Geol. Canada, 1863, p. 384, figs. 415 *a–c*.
Cyrtina hamiltonensis Hall, 1867. Pal. N. Y., vol. iv, p. 268, pl. xxvii, figs. 1–4; pl. xliv, figs. 26–33, 38–52.
Hamiltonensis Meek, 1869. Trans. Chicago Acad. Sci., vol. i, p. 99, pl. xiv, figs. 5, 7, and 10.
Hamiltonensis Nicholson, 1874. Rep. Pal. Prov. Ontario, p. 83.
Compare *Cyrtina heteroclita* of authors.

The only specimen of this species recognized in the Eureka District collection is from the Upper Devonian horizon; it is a silicified shell preserving the two valves united, and below the average size of full grown individuals from the Hamilton Group of New York and Canada; there appears to be little question of its specific identity with them.

In the collection of Devonian fossils from the Mackenzie River, British America, Mr. F. B. Meek recognized this species (Trans. Chicago Acad. Sci., vol. i, p. 100), and he also states that it occurs on Porcupine River, a tributary of the Yukon, longitude 140° W., latitude 67° N.

Formation and locality.—Upper Devonian, at The Gate, northwest of Eureka, Nevada.

Genus NUCLEOSPIRA Hall.

Nucleospira concinna Hall.

Atrypa concinna Hall, 1843. Geol. Rep. Fourth District New York, p. 200, fig. 3.
Nucleospira concinna Hall, 1859. Twelfth Ann. Rep. N. Y. State Cab. Nat. Hist., pp. 25 and 26. *Ibid.*, Hall, 1867. Pal. N. Y., vol. iv, p. 279, pl. xlv, figs. 33 to 57.

This species is a rare form in Nevada, having been found but sparingly at one locality. At the East it has a wide geographic range in the State of New York, and is also found in the States of Virginia, Maryland, and Indiana. It ranges vertically from the Schoharie grit up into the Hamilton Group.

Formation and locality.—Lower horizon of the Devonian limestone, Lone Mountain, northwest of the Eureka District, Nevada.

Genus ATHYRIS McCoy.

Athyris Angelica Hall.

Athyris angelica Hall, 1861. Fourteenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 99.
Hall, 1867. Pal. N. Y., vol. iv, p. 292, pl. xlvii, figs. 9–20.

This species, in New York, is known only in the Chemung Group, a horizon comparable with the upper beds of the Devonian of the Eureka District, although the fauna is not as specialized as in the East. In all essential particulars the specimens from these widely separated localities are specifically identical, with the exception of one feature, which has not been observed in the New York examples. When the outer part of the shell, with the imbricating lamellæ or lamelliform striæ is exfoliated, the entire surface is more or less marked by radiating striæ. The form of the shell varies, as in the New York specimens, from transverse to elongate, the latter usually prevailing.

Formation and localities.—Devonian limestone, The Gate, northwest of Eureka, and Newark Mountain, Eureka District, Nevada.

Athyris (sp. undt.).

A single specimen of this form with the shell exfoliated, except on the upper portion, occurs at Lone Mountain, low in the Devonian. It resembles *Athyris cora*, of the Hamilton and Chemung Groups of New York (Pal. N. Y., vol. iv, 291, pl. xlvii, figs. 1–7), but is probably a distinct species.

Genus MERISTELLA Hall.

Genus WHITFIELDIA Davidson.

Meristella (Whitfieldia) nasuta Conrad (Sp.)

Plate iii, figs. 8, 8*a*, 8*b*.

Atrypa nasuta Conrad, 1842. Jour. Acad. Nat. Sci. Philad., vol. viii, p. 265, figs. 8, 9.
Meristella nasuta Hall, 1860. Thirteenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 93.
elissa Hall, 1861. Fourteenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 100.
Ibid., 1862. Fifteenth Ann. Rep., pl. iii, figs. 21, 22.
nasuta Hall, 1862. Fifteenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 160, figs. 17–19 of p. 161.

Athyris Clara Billings, 1860. Canadian Journal, vol. v, p. 274, figs. 29–32. *Ibid.*, 1863. Geology of Canada, p. 373, figs. 397 *a*, *b*.
Meristella nasuta Hall, 1867. Pal. N. Y., vol. iv, p. 299, pl. xlviii, figs. 1–25.
Athyris nasuta Nicholson, 1874. Pal. Prov. Ontario, p. 86.
Compare *Whitfieldia tumida* Dalman's (Sp.).

Professor Hall (Pal. N. Y., vol. iv, p. 299) cites *Atrypa nasuta* Conrad Ann. Report on the Paleontology of New York, p. 18. I have not been able to find any such reference, but find the original description in the Journal of the Philadelphia Academy of Natural Sciences, as cited above.

A number of examples of this species occur at the Lower Devonian horizon of Lone Mountain, in association with other well-known Upper Helderberg or Corniferous limestone fossils of the eastern side of the continent. None of them attain the large size of many specimens from New York and Canada, but their specific identity with specimens of a corresponding size scarcely permits of question. The presence of a narrow depressed line or median sinus on both valves is a character absent on *M. nasuta*, but present in the closely allied *Whitfieldia tumida* Dalman (sp.) (Davidson, 1882, Mon. Brit. Foss. Brach., vol. v, p. 107) of the Upper Silurian. The broader depressed fold of the dorsal valve and rounded sinus of the ventral valve are also more characteristic of the latter species.

I am very much inclined to identify this Nevada shell with *Whitfieldia tumida*, as *M. nasuta* is scarcely more than a variety of it that obtains, in its later stages of growth, a greater prolongation of the valves. If either the Nevada or New York shells were found in association with *M. tumida*, they would scarcely be distinguished in external characters as more than a variety. For the purpose of more clearly presenting the relations of the Devonian faunas of the Rocky Mountains and the eastern half of North America, and while awaiting more material for study, we have retained species under separate names that are considered as varieties of some well-known species.

Formation and locality.—Lower Devonian of Lone Mountain, 18 miles northwest of Eureka, Nevada.

Genus ATRYPA Dalman.

Atrypa reticularis (Linnæus sp.) Dalman.

Plate xiv, figs. 6, 6*a*, *b*.

Synonyms: See Davidson's Monographs of the British Silurian and Devonian Brachiopoda.

This extremely variable species is represented by three distinct types in the collections from the Eureka District and Lone Mountain.

The first is a large, robust form similar to that occurring in the Upper Helderberg limestone and Hamilton shales of New York, and designated by Mr. Vanuxem as *Hipparionyx* (*Atrypa*) *consimilaris*, and is illustrated as a variety of *Atrypa reticularis* (Pal. N. Y., vol. iv, p. 319, pl. lii, figs. 9–12).

The variations from this, as shown on the following plate (*loc. cit.*), also occur at the lower horizon of the Devonian limestone at County and Woodchoppers Peaks, Sentinel Mountain, Eureka District, and Lone Mountain, 18 miles northwest of Eureka, Nevada.

The second variety is more symmetrical and has very fine radiating costæ, resembling the variety from the Hamilton and Chemung Groups in the State of Iowa. The radiating costæ, however, are finer, approaching in this respect the radiating striæ of the Silurian shell *Zygcspira Headi* Billings (Pal. Ohio, vol. i, p. 127). It is found in the upper part of the Devonian at Rescue Hill, at the mouth of Packer Basin, and at The Gate, northwest of Eureka.

The third variety also occurs in the higher beds of the formation at The Gate and east of the Sugar Loaf. In form it is similar to the Silurian examples from the Niagara limestone of New York (Pal. N. Y., vol. ii, p. 270, pl. lv, figs. 5 *a–u*). An illustration of it is given on plate xiv, figs. 6, 6*a*, *b*, of this report.

Formation and locality.—Throughout the Devonian limestone of the Eureka District.

Atrypa desquamata Sowerby.

Plate xiv, figs. 4, 4*a*.

Synonyms: See Davidson's Monograph of British Fossil Brachiopoda, vol. iii, pt. 6, p. 58, pl. xi, figs. 1–9.

Several examples of a species of Atrypa, with a distinctly defined area and circular foramen on the ventral valve, were found in the lower beds of the Devonian limestone associated with *Atrypa recticularis.* They are readily separated from that species, but not from the young shell of *A. desquamata*, as illustrated by Davidson, to which they are specifically related. The largest specimen has a length of 16^{mm}, width of 17^{mm}, and depth of the two valves of 8^{mm}. *A. desquamata* is a much larger and more robust species when fully developed, but the similarity in the young shells of the two forms is so strong that we cannot but consider them as specifically identical.

Formation and localities.—Lower horizon of the Devonian limestone, Atrypa Peak, south spur; and Lone Mountain, 18 miles northwest of Eureka, Nevada.

Genus TREMATOSPIRA Hall.

Trematospira infrequens, n. sp.

Plate iv, figs. 3, 3 *a*, *b*.

Shell transversely elliptical, moderately convex; hinge about three-fourths the width of the shell.

Ventral valve not quite as convex as the dorsal; mesial sinus well defined from the beak to the anterior margin and marked by a single small median plication; beak elevated, small, and truncated by a small perforation. The dorsal valve has a low mesial fold outlined by two strong plications.

Surface of the ventral valve marked by two strong and one slight plication each side of the plication on the edge of the mesial sinus; ventral valve by the same number each side of the central plications of the mesial fold. Shell structure punctate.

This is a distinct and well-marked species, approaching *Trematospira camura* Hall, 1852 (Pal. N. Y., vol. ii, p. 273, pl. lvi, figs. 3 *a–t*), of the Niagara Group and *T. gibbosa* Hall, 1867 (Pal. N. Y., vol. iv, p. 272, pl. xlv, figs. 7–15) of the Hamilton Group of New York more nearly than any other species with which we are acquainted.

Formation and locality.—Lower Devonian, Lone Mountain, 18 miles northwest of Eureka, Nevada.

Genus RHYNCHONELLA Fischer.

Rhynchonella Horsfordi Hall.

Plate xiv, fig. 3; plate xv, fig. 6.

Rhynchonella horsfordi Hall, 1860. Thirteenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 87.
(*Stenocisma*) *horsfordi* Hall, 1867. Pal. N. Y., vol. iv, p. 339, pl. liv, figs. 24–32.

A comparison of the Nevada forms of this species with those of the same stage of development from New York prevents their specific separation. But few specimens were found, and it is not an abundant shell in New York, although occurring in the Marcellus and Hamilton shales.

Formation and locality.—Devonian limestone, Atrypa Peak, Eureka District, Nevada.

Rhynchonella Tethys Billings.

Rhynchonella tethys Billings, 1860. Canadian Journal, vol. v, p. 270, figs. 20–22.
(*Stenocisma*) *tethys* Hall, 1867. Pal. N. Y., vol. iv, p. 335, pl. liv, figs. 1–8.

This species is very closely related to the preceding, and in making a comparison of the two species with the specimens from Nevada, it is difficult to recognize constant specific characters that distinguish them. Both species are represented in the collections by the extreme forms, and until a large number of well-preserved specimens are collected, it may be premature to propose to unite them in one species.

Formation and localities.—In the Lower Devonian horizon at Comb's Peak, and at Lone Mountain, 18 miles northwest of Eureka, Nevada.

Rhynchonella? occidens, n. sp.

Plate xv, figs. 3, 3 *a*, *b*.

Shell small, suboval to globose; strongly plicated. Ventral valve slightly less convex than the dorsal.

Ventral valve somewhat convex above, becoming depressed midway of its length, with a shallow sinus that extends down and curves beneath; sides uniformly convex to the margins. Beak somewhat elevated and curving over that of the dorsal valve. Dorsal valve about as wide as long, strongly convex, and with a well-defined mesial elevation on the lower half of the valve; sinuate in front to unite with the projections of the mesial fold of the opposite valve.

Surface with from eleven to thirteen simple, angular plications that gradually increase in size from the apex; of these there are four on the median elevation and three on the sinus.

The dimensions of the largest specimen are: Length, 8^{mm}; width, 6^{mm}; distance through the greatest convexity of the shell, 5.5^{mm}; of the smallest specimen: length, 4^{mm}; width, 3.75^{mm}; convexity, 3^{mm}. The latter has the plications and the mesial fold and sinus developed as in the larger shell. Other examples are less convex, and with the fold and sinus scarcely defined.

In its general aspect this species is similar to some forms of the genus Rhynchospira, and with the discovery of more perfect specimens showing the beak and area of the ventral valve, and the interior spires, if they exist, it may possibly be referred to that genus.

Formation and locality.—Lower horizon of the Devonian limestone, Comb's Peak, Eureka District, Nevada.

Rhynchonella castanea Meek.

Plate xv, figs. 1, 1 *a*, 4, 4 *a*.

Rhynchonella castanea Meek, 1868. Trans. Chicago Acad. Sci., vol. i, p. 93, pl. xiii, figs. 9 *a–c*.

Shell subglobose; ventricose on the dorsal side, and somewhat flattened on the ventral; length and breadth subequal or a little longer than wide.

Ventral valve slightly convex on the umbo, flattened or slightly convex on the sides, and with a more or less well defined sinus that is first seen about the center of the valve. The sinus has from three to six depressed, rounded plications, and varies in form from the subquadrate, linguiform extension, with subparallel sides in the smaller shells, where it is strongly incurved, to the shorter depression outlined by the elevated, acute margins on the lower part that is not curved beneath even in large individuals. Beak abruptly incurved over that of the opposite valve.

Dorsal valve gibbous, sloping somewhat abruptly to the margins of the opposite valve; mesial fold prominent in the younger shells, and marked with three or four plications that extend up to the upper third of the valve. In older specimens the fold is scarcely traceable above the middle of the valve, and the plications, six or eight, are usually short and confined to the lower part.

Surface of younger shells with obscure plications on the sides and stronger, depressed, rounded plications on the mesial fold and sinus. Concentric lines of growth mark the upper part of each valve. The surface of the older shells is smooth with the exception of the plications on the mesial fold and sinus and a few lines of growth.

This is a somewhat variable species in its different stages of growth. The younger shells are subcuboidal and of the type of *Rhynchonella venustula* Hall (Pal. N. Y., vol. iv, p. 346, pl. liv, A, figs. 24–43) of the Tully limestone of New York, while the adults are subglobose, with the ventral valve less convex, and the angle formed by the union of the sides of the two valves more acute. The two extremes of growth might readily be separated as distinct in their specific characters. The species is of the type of *Rhynchonella Emmonsi* Hall and Whitfield (Geol. Expl. Fortieth Par., vol. x, p. 247, pl. iii, figs. 4–8) from the Devonian limestone of White Pine Mountains, Nevada; but it is specifically distinct from that species, and also *R. venustula* and *R. cuboides* Sowerby (sp.) (Davidson, Mon. Brit. Foss. Brach., vol. iii, pt. 6, p. 65, pl. xiii, figs. 17–21) of the same group of species, although more or less resembling them in some of its phases of development.

The above was written before I had seen the description and illustration of Mr. Meek's species, *R. castanea*, from the Devonian limestone in the Mackenzie River Basin. A careful comparison of the Nevada specimens with Mr. Meek's description and figures, leads to the opinion that *R. castanea* is one of the variations of the species as it occurs in the Eureka District, and that the latter form should be united with it under the same specific designation, as also the shell illustrated by Mr. Meek as probably a distinct species (Trans. Chicago Acad. Sci., vol. i, plate xiii, fig. 10*a*, *b*), but which is the more convex or subcuboidal form of the species.

The locality of the type of *R. castanea* is given as Lockhart River, British America, latitude, 67° 15′; longitude, 126° W.

Formation and localities.—Upper Devonian limestone of Rescue Hill and the mouth of Packer Basin, and Lower Devonian on the west slope of County Peak, Eureka District, Nevada.

Rhynchonella duplicata Hall.

Plate xiv, fig. 8.

Atrypa duplicata Hall, 1843. Rep. Fourth Geol. Dist. N. Y., Organic Remains of the Chemung Group, No. 67, figs. 2, 2 *a–b*.
Rhynchonella (*Stenocisma*) *duplicata* Hall, 1867. Pal. N. Y., vol. iv, p. 350, pl. lv, figs. 17–25.

This species has hitherto been known in only a few localities of the Chemung Group in New York. Its author states that it is usually about three-eighths of an inch in length and breadth, rarely attaining the length of half an inch (12.5^{mm}). The size is less than that of the Nevada specimens, but otherwise the two are in all essential particulars specifically identical. A very perfect shell from the limestone east of the Sugar Loaf has a length of 18^{mm}, with a width of 19^{mm}, and corresponds in nearly every detail with the type of the species. A large number of perfect specimens were collected at Rescue Hill that present slight differences, which, however, are not considered of specific value. The sharp angular plications and the margins of the sinus on the ventral valve are rounded and depressed; the shells are broader than long, having a proportion of 6 to 5, and usually more ventricose, which gives a deeper and more incurved sinus.

Formation and localities.—Devonian limestone. Rescue Hill and east of the Sugar Loaf, Eureka District, Nevada.

Rhynchonella pugnus Martin.

Plate xiv, figs. 7, 7*a*.

Conchyliolithus anomites pugnus Martin, 1809. Petrificata Derbiensia, tab. xxii, figs. 4, 5.
Atrypa pugnus Sowerby. Geol. Trans. 2d Series, vol. v, pl. lvi, figs. 15–18.
Terebratula pugnus Phillips, 1841. Paleozoic Fossils of Devon., etc., p. 87, pl. xxxv, figs. 156 *a–e*.
anisodonta Phillips, 1841. *Ibid.*, p. 86, pl. xxxiv, figs. 154 *a–c*.

Rhynchonella pugnus Davidson, 1861. Mon. Brit. Carb. Brach., p. 97, pl. xxii, figs. 1–15. *Ibid.*, Mon. Brit. Devonian Brach., 1865, p. 63, pl. xii, figs. 12–14; pl. xiii, figs. 8–10.

Missouriensis Meek, 1866. Geol. Survey Illinois, vol. ii, p. 153, pl. xiv, figs. 4 *a*, *b*. Fig. 5 *a* of pl. C., 2d Ann. Rep. Geol. Surv. Missouri, 1855, is also referable to *Rhynchonella pugnus*, as stated by Mr. Meek. Not *R. Missouriensis* Meek, 1868. *Ibid*, vol. iii, p. 450, pl. 14, fig. 7 *a–d*.

alta Calvin, 1877. Paper read before the Iowa Academy of Sciences and a named photographed plate distributed.

pugnus Williams, 1883. Amer. Jour. Sci., vol. xxv, p. 99.

The varietal differences among the Nevada specimens from the same layer or rock are quite marked, in this respect resembling the New York forms described by Prof. H. S. Williams (Amer. Jour. Sci., vol. xxv, p. 97, 1883) and the English type illustrated by Mr. Davidson more than the Iowa form of Mr. Calvin, although medium-sized specimens appear to be perfectly identical with the latter.

The plications on the valves vary from eight to ten on some examples and four to six on others. In the young and medium-sized shells the plications do not extend more than one-half the way up from the anterior margin, while in the larger examples they reach nearly to the extremity of the beak.

Under the name of *Rhynchonella Missouriensis* Shumard, Mr. Meek, *loc. cit.*, describes and illustrates a shell which he considered as closely allied to varieties of *Rhynchonella reniformis* and *R. pugnus*, from the Carboniferous limestone of England and Ireland. This type was what Dr. Shumard considered as the young of *R. Missouriensis*, describing and illustrating at the same time a larger shell generically distinct from it, if we consider his figure, 5 *a* (2d Ann. Rep. Geol. Surv. Missouri, plate C), as a form of *R. pugnus*, as suggested by Mr. Meek. Later, in vol. iii of the Illinois Survey, Mr. Meek describes and illustrates the larger shell described by Dr. Shumard, and again speaks of the relations between the smaller shell figured by Dr. Shumard and *R. pugnus*, retaining the name *R. Missouriensis* for the former if the latter proved to be identical with *R. pugnus*.

In the collections of the American Museum of Natural History, Prof. R. P. Whitfield showed me casts of Shumard's *R. Missouriensis* that prove it to belong to the genus Camarophoria as determined by him.

Formation and locality.—Devonian limestone; associated with *R. duplicata* and *R.* (*L.*) *Laura*. The Gate, northwest of Eureka, Eureka District, Nevada.

Rhynchonella Emmonsi H. & W.

Rhynchonella Emmonsi Hall & Whitfield, 1877. Geol. Expl. Fortieth Par., vol. iv, p. 247, pl. iii, figs. 4–8.
intermedia Barris, 1878. Proc. Davenport Acad. Nat. Sci., vol. ii, p. 285, pl. xi, figs. 5–6.

With the type of *Rhynchonella Emmonsi* before me, and a typical specimen of *Rhynchonella intermedia*, received from Rev. W. H. Barris, to compare with it, I fail to observe any specific differences between them. The slight differences mentioned by the author of *R. intermedia* would not serve to separate the two shells, if found in the same stratum of rock, and the range of variation in most species of the genus Rhynchonella is far greater than between the two shells under consideration. *R. Emmonsi* is a rare form in the Upper Devonian of the White Pine District, Nevada, and Rev. Mr. Barris writes me that it is also rarely met with in the Upper Devonian of Iowa.

There is little doubt but that *Rhynchonella intermedia*, *R. Emmonsi*, and *R. venustula* Hall are varieties of *R. cuboides* of the Devonian of Europe, and when the opportunity offers to illustrate a series of specimens I think this can readily be shown.

Many American species now under local names will ultimately be placed with species described from Europe, and the reverse will also be true when American species have priority. Our knowledge of the widespread geographic distribution of paleozoic species will be greatly increased with better facilities for the comparison of specific forms from the great continental areas and islands.

Subgenus LEIORHYNCHUS Hall.

Rhynchonella (Leiorhynchus) Nevadensis, n. sp.

Plate xiv, figs. 9, 9 *a*, *b*.

Shell ovate or suborbicular, usually broader than long, or length and breadth subequal; increases in rotundity with growth.

Ventral valve in adult individuals gibbous above, curving uniformly to the sides or becoming slightly depressed, flattened below the center, and more or less sinuate on the lower part. Beak acute and closely incurved over that of the opposite valve. Dorsal valve uniformly convex, the convexity increasing with the size of the individual; a broad, hardly perceptible mesial fold is seen on the lower part of the valve only in the larger shells.

Surface marked by a few obscure plications on the mesial fold and in the sinus that become obsolete midway to the apex. On the surface of well-preserved specimens concentric striæ occur which at intervals are crowded together, forming slight ridges.

There is considerable variation between young and adult specimens. Those 15^{mm} in length show but a trace of the mesial fold and sinus or of the surface plications; the ventral valve is more uniformly convex, less depressed below, and subequal to that of the dorsal valve. In this condition it bears a close resemblance to the young shells of some of the larger forms of the genus Meristella.

This species is closely related to *R.* (*L.*) *Kelloggi* Hall (Pal. N. Y., vol. iv, p. 361, pl. lvii, figs. 1–12) of the Chemung Group of New York, the character of the mesial fold and sinus and the surface plications serving to distinguish it from that species.

Formation and locality—Devonian limestone. Rescue Hill, near Rescue Cañon, Eureka District, Nevada.

Rhynchonella (Leiorhynchus) sinuatus Hall.

Plate xiv, fig. 5.

Leiorhynchus sinuatus Hall, 1867. Pal. N. Y., vol. iv, p. 362, pl. lvii, figs. 13–17.

The specimens of this species from the Chemung Group of New York are all more or less compressed, and none show the true convexity of the shell and surface plications. With this in view, the perfect and uncompressed specimens from the limestone of the Eureka District are specifically identical with them. There is considerable variation among the specimens from the same bed; some are more elongate than the New York forms, while others are almost a counterpart of them.

Formation and localities.—Upper horizon of the Devonian limestone; The Gate, northwest of Eureka, Rescue Hill, and near the mouth of Packer Basin, Eureka District, Nevada.

Rhynchonella (Leiorhynchus) Laura Billings.

Rhynchonella ? Laura Billings, May, 1860. Canadian Journal, vol. v, p. 273, figs. 26–28.
Leiorhynchus multicosta Hall, December, 1860. Thirteenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 85.
Rhynchonella ? Laura Billings, 1863. Geol. of Canada, p. 384, figs. 418 *a–c*.
Leiorhynchus multicosta Hall, 1867. Pal. N. Y., vol. iv, p. 358, pl. lvi, figs. 26–40.

The Nevada examples of this species are usually broader, more convex, and with stronger plications than those from the argillaceous shales of the Hamilton Group of New York. These features, however, are quite as prominent in the specimens from the arenaceous beds at Richmondville, Schoharie County, New York, and the calcareous shales at Bosanquet and Widder, Canada West. The latter localities afford specimens showing the phases of development observed in the New York and Nevada examples, and show the specific connection of the eastern and western forms.

Formation and locality.—Upper horizon of the Devonian limestone; associated with *Rhynchonella pugnus*, at The Gate, northwest of Eureka, Nevada.

Genus PENTAMERUS Sowerby.

Subgenus GYPIDULA Hall.

Pentamerus comis Owen.

Plate iii, figs. 4 and 7; pl. xiv, figs. 15, 15 *a*, *b*; pl. xv, figs. 5, 5 *a*, *b*.

Atrypa comis Owen, 1852. Rep. Geol. Surv. Wis., Iowa, and Minn., p. 583, pl. iii A, fig. 4.
Pentamerus occidentalis Hall, 1858. Geol. Iowa, vol. i, pt. 2, p. 514, pl. vi, figs. 2 *a–c*. Not *Pentamerus occidentalis* Hall, 1852, Pal. N. Y., vol. ii, p. 341, pl. lxxix, figs. 1 *a–s*, 2.
Pentamerus galeatiform Meek & Worthen, 1866. Geol. Surv. Illinois, vol. ii, p. 325, (foot note.)
Gypidula occidentalis Hall, 1867. Pal. N. Y., vol. iv, p. 380, pl. lviii *a*, figs. 1–8.
Pentamerus comis Meek & Worthen, 1868. Geol. Surv. Illinois, vol. iii, p. 428, pl. xiii, figs. 6 *a–c*.

Shell ovoid or subglobose; very inequivalve; hinge line varying from two-thirds to three-fourths of the entire width of the shell.

Ventral valve arcuate, much deeper than the dorsal, gibbous or regularly ventricose above the middle; beak strongly incurved over that of the opposite valve; fissure of medium size, and bordered by a more or less distinct area, the surface of which is smooth or transversely striated. The spoon-shaped pit in the interior of the valve is moderately extended; median septum very short. Central portion of the valve with a slightly elevated, broad, more or less distinctly defined mesial fold.

Dorsal valve full above, becoming depressed below the middle and flattened at the sides; the front is flattened and slightly extended, forming a broad, more or less distinct sinus. Lamellæ separate and diverging.

Surface obscurely plicated on the lower central portion of the larger shells, and one shows traces of very fine radiating striæ on the lower part of the ventral valve.

The specimen described is smaller than the average, having a height and width of 35^{mm}, with the diameter of the convexity of the valves of 30^{mm}; a large ventral valve is 50^{mm} in length.

Formation and localities.—Devonian limestone, lower horizon; Comb's Peak, Eureka District, and Lone Mountain, 18 miles northwest of Eureka, Nevada.

The most striking differences between the Nevada shell and that of Iowa is the great size and the almost entire absence of plications on the former. We cannot, however, avoid the conclusion that they belong to the same species, the Nevada form attaining a greater size and in many instances a broader form. In other examples the specific identity is without question.

When preparing specimens for the draughtsman it was thought that figs. 15, 15 *a*, *b*, plate xiv, represented one species, figs. 5, 5 *a*, *b* another, and *Pentamerus occidentalis* Hall, *loc. cit.*, still another.

By the collection of a large series of specimens from the original locality in Nevada, and the bringing together of a fine suit of specimens representing the Devonian *P. occidentalis* Hall (the latter through the kindness of Prof. Samuel Calvin and Rev. William H. Barris, of Iowa), I found that the three varieties were united by a series of specimens having intermediate characters between the extremes I had designated as distinct species. On examining the interiors of the valves of the Iowa and Nevada shells, they were found to be similar; also the area, which is of a variable character. In a beautiful series of specimens from Independence, Iowa, received from Professor Calvin, the area of the ventral valve varies greatly in extent and height, and many of them showed no more of a decided area than specimens of *P. galeatus*, now before me, from the Lower Helderberg Group of Albany County, New York. On one of Professor Calvin's specimens from Solon, Iowa, the area appears to be vertically striated, but a close examination shows this to have originated from the scratching of the tool used in cleaning away the matrix. All other specimens from Iowa and Nevada showing the area intact, are transversely striated. When the area is not well defined the striæ of growth arch around the rounded lateral margins and reach in to the edges of the vertical fissure. Professor Hall describes the area as vertically striated; we have failed to find any specimens showing the vertical striæ. The presence of fine radiating striæ is not mentioned either by Owen, Hall, or Meek and Worthen, but they are present on specimens from Davenport, Troy Mills, and Independence, Iowa, and the Eureka District, Nevada. Concentric striæ are also well defined on many specimens, while others show little more than a smooth surface.

I think the identification of this species by Meek and Worthen with that of Owen is correct, and it also establishes a specific name, as the genus Gypidula Hall, does not appear to have good generic characters to distinguish it from typical forms of Pentamerus, and if the species is referred back to the latter genus, the name *occidentalis* cannot be used owing to its being preoccupied.

Pentamerus Lotis, n. sp.

Plate iii, figs. 9, 9*a–c*.

Shell small, subglobose, transverse or with the height and width subequal.

Dorsal valve deeper and more convex than the ventral; regularly arched from beak to front, with a strongly marked somewhat flattened mesial fold having a shallow median sinus; beak short, incurved. Ventral valve most convex towards the beak, flattening out in the broad mesial sinus; the latter is marked by a low rounded median plication.

Surface of dorsal valve marked by a single low plication on each side of the mesial fold that corresponds to a shallow sinus each side of the plication bordering the large mesial sinus of the ventral valve; a few fine concentric lines of growth are visible by the aid of a strong lens.

Dimensions: height of largest specimen in the collection, 9^{mm}; width, 12^{mm}; convexity of the two valves united, 8^{mm}.

On a shell having a height of 4^{mm}, a transverse diameter of 5^{mm}, and a depth of 2.25^{mm} for the two valves, the mesial sinus and fold are shown only by an undulation in the front margin, the valves are subequal in convexity and the beak of the dorsal valve is scarcely elevated above that of the ventral. With the increase in the size of the shell, the features of the adult gradually appear until, in the largest specimens, there is very little variation in form except a greater or less convexity as the shell is more or less transverse.

Of American species *Pentamerus subglobosus* M. & H. (Geol. Illinois, vol. iii, p. 429, plate xiii, figs. 5 *a–c*), approaches this species in size and form, but the numerous plications and different convexity of the valves distinguish them. *Pentamerus biplicatus* Schnur, of the Middle Devonian of England (Davidson, Mon. Brit. Foss. Brach., vol. iii, p. 73), may also be compared with *P. Lotis.*

It is with considerable hesitancy that this Upper Devonian shell is referred to a new species, as it may possibly be a form descended from *P. comis*, of the Lower Devonian of the Eureka District. No young shells of the latter species have been found that we can compare with the earlier stages of growth of *P. Lotis*, but in the larger form of the two species decided differences appear, as may be seen by a comparison of the figures representing them.

Comparing *P. Lotis* with smooth specimens of *P. comis*, from the Upper Devonian horizon at Rockford, Iowa, we find a decided resemblance between them, but not sufficient to unite them as one species.

Formation and locality.—Upper Devonian, on the west side of Applegate Cañon, White Pine Mining District, Nevada.

Genus CRYPTONELLA Hall.

Cryptonella? circula, n. sp.

Plate xv, figs. 2, 2*a*, *b*.

Shell small, subcircular or ovoid. The depth of the two valves, in uncompressed specimens, is equal to one-half the length of the shell.

Ventral valve moderately convex, most prominent about one-third the distance from the apex to the front, from which point it slopes regularly to the margins and beak; a slight depression of the front margin is the only indication of a mesial sinus; beak scarcely incurved, truncated by a small round foramen, that, in the absence of the deltidial plates, opens below into a rather large deltoid fissure that has a narrow, flattened, area-like space on each side. Dorsal valve somewhat shorter than the ventral and subequal in convexity with it. Beak very small and not perceptibly incurved.

Surface marked by fine concentric striæ. Shell structure punctate.

Dimensions: the largest shell, in a collection of thirty specimens, has a length of 9^{mm}, breadth of 8.5^{mm}, and depth of the two valves of 4.5^{mm}.

The species is referred to the genus Cryptonella, from its general form, the character of the beak of the ventral valve and the punctate shell structure, the latter character shown on one of the silicified specimens. With these characters the reference is provisional, as the internal features are yet undetermined.

Formation and locality.—Devonian limestone; Lone Mountain, 18 miles northwest of Eureka, Nevada.

Cryptonella Pinonensis, n. sp.

Plate iv, figs. 4, 4*a*, *b*.

Shell subovate; widest about the middle; valves about equally convex; rounded to slightly transverse in front.

Ventral valve regularly arcuate, most convex midway; beak elevated, slightly incurved, and truncated by a small rounded foramen bounded on the lower side by two rather prominent deltidial pieces; the slopes from the beak are abruptly deflected on the sides down to the cardinal margin.

Dorsal valve not quite as convex as the ventral; most elevated at the center, from which point it curves regularly to the margins; beak incurved beneath the deltidial plates of the ventral valve.

Outer surface exfoliated. Shell structure punctate.

The generic reference is based entirely on external form and character; nothing is known of the interior characters, except two elongate, median, muscular imprints on the ventral valve. The specific relations appear to be nearest some forms of *Cryptonella planirostra* of the Hamilton Group of New York. A direct comparison with the types of that species, and also of *C. rectirostra* Hall, leads us to think that the Nevada form is distinct from each.

Formation and locality.—Upper Devonian; south end of the Piñon Range at The Gate, northwest of Eureka, Nevada.

LAMELLIBRANCHIATA.

Our knowledge of this class of shells in the Devonian Group of the area embraced within the Rocky Mountains has been up to the present time very limited, Mr. Meek having described but three species, viz, *Edmondia ? Pinonensis*, *Aviculopecten catactus*, and *Lunulicardium fragosum*, the types of which were collected by the geologists of the Fortieth Parallel Geological Survey, in Central Nevada. To this list we have added twenty-three genera, represented by thirty-five species. Of these, eight species are identical with species in the Eastern Paleozoic area of Ohio and New York, viz:

Actinopteria Boydi.
Paracyclas occidentalis.
Pterinea flabella.
Leiopteria Rafinesqui.
Sanguinolites rigidus.
Sanguinolites ? Sanduskyensis.
Sanguinolites ventricosus.

All of the twenty-three genera, with the exception of Posidonomya, are identical with Devonian genera of the Eastern United States.

In the systematic catalogue at the end of this volume the vertical range of the various species in the Devonian Group of the Eureka District is given.

From the results obtained by a few days' collecting at the Lower Devonian horizon, there is little doubt but that by a more extended search the number of species could be greatly increased over the twenty-seven now known from that horizon.

One species, *Paracyclas occidentalis*, passes from the lower to the upper horizon, and unites with the eight species occurring there to make a total of nine species occurring in a horizon stratigraphically equivalent to that of the Chemung Group of New York.

Genus PTERINEA Goldfuss.

Pterinea flabella Conrad (Sp.).

Plate xv, fig. 12; pl. v, fig. 6.

Avicula flabella Conrad, 1842. Jour. Acad. Nat. Sci. Philad., vol. viii, p. 238, pl. 12, fig. 8.
Pterinea flabellum Hall & Whitfield, 1872. Twenty-fourth Ann. Rep. N. Y. State Museum Nat. Hist., p. 199.
Hall, 1883. Pal. N. Y., vol. v, pt. 1, Plates and Explanations, p. 7; pl. xiv, figs. 1–21; pl. xv, figs. 1, 4, 5, 8–10. *Ibid.*, 1884, Text, p. 93.

This species, which in Ohio and New York ranges from the Upper Helderberg to the Chemung Groups, is found only at the Lower Devonian horizon of Lone Mountain, 18 miles northwest of Eureka, Nevada.

The specimen illustrated shows the characteristic form, and is similar to that from the typical localities in the Hamilton Group of New York.

Pterinea Newarkensis, n. sp.

Plate v, fig. 12.

General form broadly truncate, suboval; length and breadth subequal; cardinal margin straight, nearly if not quite equaling the greatest width of the valves.

The right valve is depressed, slightly convex at the umbonal region; beak depressed; anterior surface of posterior wing marked by a few linear, radiating lines, the body of the shell showing only a few concentric lines of growth. The posterior muscular scar is oval in form and quite shallow.

Left valve unknown.

Dimensions: length of shell, 4.5^{cm}; width the same.

This species is closely related to *Pterinea Chemungensis* Conrad (Pal. N. Y., vol. v, pt. 1, p. 98, 1884) from the Devonian of New York. It differs in the more anterior position of the beak and less elongate outline.

Formation and locality.—Upper Devonian of Newark Mountain, Eureka District, Nevada.

Genus ACTINOPTERIA Hall.

Actinopteria Boydi Conrad (Sp.).

Plate v, fig. 2.

Avicula Boydii Conrad, 1842. Jour. Acad. Nat. Sci. Philad., vol. viii, p. 237, pl. xii, fig. 4.
Pterinea Boydi Miller, 1877. Cat. Amer. Pal. Fossils, 2d ed., p. 201.
Actinoptera Boydi Hall, 1883. Pal. N. Y., vol. v, pt. 1, Plates and Explanations, p. 8; pl. xix, figs. 2–24.
Actinopteria Boydi Hall, 1884. Pal. N. Y., vol. v, pt. 1, p. 113.

There is only a single left valve of this species in the collection, and that is somewhat distorted by pressure. A direct comparison with authentic specimens from the Hamilton Group of New York shows such a striking similarity between them and the Nevada shell that there is little hesitancy in identifying the species by the one specimen.

Formation and locality.—Lower Devonian of Lone Mountain, 18 miles northwest of Eureka, Nevada.

Genus LEIOPTERIA Hall.

Leiopteria Rafinesquii Hall.

Plate v, figs. 10, 10*a*.

Leiopteria Rafinesquii Hall, 1883. Pal. N. Y., vol. v, pt. 1, Plates and Explanations, pp. 7, 9; pl. xv, fig. 11; pl. xx, figs. 6, 7. *Ibid.*, 1884, text, p. 161.

The examples of this species from Nevada embrace both the Upper Helderberg and Hamilton Group forms, as illustrated in the Paleontology of New York. The identification is made with the figures, as we have no typical specimens of the species for comparison.

Formation and locality.—Lower Devonian of Brush Peak and Atrypa Peak, Eureka District, Nevada.

Genus LEPTODESMA Hall.

Leptodesma transversa, n. sp.

Plate v, fig. 13.

General form transversely ovate or oblong. General surface of the left valve strongly convex, but not gibbose. Hinge straight and continued posteriorly to the acute termination of the wing, which appears to have had a short spinose extension. Beaks small, arching over the cardinal line.

Surface marked by numerous concentric lines of growth.

Interior characters unknown.

Dimensions: height, 7^{mm}; breadth, 12^{mm}; convexity of left valve, 2.5^{mm}.

With the exception of *Leptodesma naviforme* Hall (Pal. N. Y., vol. v, pt. 1, p. 200), of the Chemung Group of New York, this species is more oblique and transverse than any species known to me.

Formation and locality.—Upper Devonian, Chemung horizon, at The Gate, northwest of Eureka, Nevada.

Genus LIMOPTERA Hall.

Limoptera sarmenticia, n. sp.

Plate v, figs. 3, 3 *a*, *b*.

Shell oblique, subovate in outline within the extension of the posterior wing. Left valve strongly convex. Hinge-line straight; ligamental area unknown. Beak of left valve elevated and incurved over the cardinal line.

Surface marked by concentric lines of growth, and not very strong radiating striæ.

Interior characters unknown.

Dimensions: height of a narrow specimen, 3.25^{cm}; breadth, 2.5^{cm}; convexity of left valve, 1.25^{cm}; of a broad specimen: height, 3^{cm}; breadth, 3^{cm}; convexity of left valve, 1.25^{cm}.

This is unlike any species of the genus known to me. The variation in form among the different specimens is considerable, as is shown by figs. 3 *a* and 3 *b*. The surface striæ are usually absent in the cast.

The specific name is given from the character of the localities at which it occurs; both Brush and Atrypa Peaks are covered with brushwood.

Another strongly marked species of Limoptera occurs in the Lower Devonian. It is much larger and more erect than the species under consideration. Unfortunately, the material does not permit of specific determination.

Formation and locality.—Lower Devonian of Brush and Atrypa Peaks, Eureka District, Nevada.

Genus MYTILARCA Hall.

Mytilarca dubia, n. sp.

Plate iv, fig. 5.

General outline broadly ovate. Hinge-line short, projecting a short distance beyond the contour of the body of the shell.

Left valve unknown. The beak of the right valve is somewhat acute and projects over and above the hinge line; area unknown. General surface strongly convex. Surface of valve apparently smooth.

Dimensions: length, 4.25^{cm}; greatest breadth, 3.75^{cm}.

In the absence of the ligamental area and the interior of the valves, this species is provisionally referred to the genus Mytilarca. In general form it is related to *Mytilarca* (*Plethomytilus*) *oviformis* (p. 169) of the Hamilton Group of New York.

Formation and locality.—Lower Devonian, Lone Mountain, 18 miles northwest of Eureka, Nevada.

Mytilarca Chemungensis Conrad.

Plate iv, fig. 9.

Inoceramus Chemungensis Conrad, 1842. Jour. Acad. Nat. Sci., Philad., vol. viii, p. 246, pl. xiii, fig. 9.

Mytilus Chemungensis Phillips & Salter, 1848. Memoirs Geol. Surv. of Great Britain, vol. ii, pt. 1, p. 365, pl. xx, figs. 10, 11. (This is probably a distinct species.)

Mytilarca Chemungensis Hall, 1870. Prelim. Notice Lam. Shells, p. 23. *Ibid.*, 1883. Pal. N. Y., vol. v, pt. 1; Plates and Explanations, p. 11; pl. xxxii, figs. 8-14. *Ibid.*, 1884. Text, p. 258.

As far as can be determined by a comparison of the single right valve that we have of this species with specimens, and also Professor Hall's figures, it is identical with the New York species. It occurs in association with the following Chemung species: *Orthis impressa*, *Productus speciosus*, *P. lachrymosa*, vars. *lima* and *stigmata*, *Spirifera disjuncta*, *Athyris Angelica*, *Rhynchonella sinuata*, *Sanguinolites rigidus*.

Formation and locality.—Upper Devonian, at The Gate, northwest of Eureka, Nevada.

Subgenus PLETHOMYTILUS Hall.

Mytilarca (Plethomytilus) oviformis Conrad.

Plate v, fig. 11.

Inoceramus oviformis Conrad, 1842. Jour. Acad. Nat. Sci., Philad., vol. viii, p. 246, pl. xiii, fig. 7.

Mytilarca oviformis Hall, 1870. Prelim. Notice Lam. Shells, p. 21.

Plethomytilus oviformis Hall, 1883. Pal. N. Y., vol. v, pt. 1; Plates and Explanations, p. 11; pl. xxxi, figs. 1–8.

Mytilarca (*Plethomytilus*) *oviformis* Hall, 1884. Pal. N. Y., vol. v, pt. 1, p. 255; pl. lxxxvii, fig. 8.

But a single left valve of this species has been obtained. In form and external characters it corresponds too closely with *M.* (*P.*) *oviformis* of the Hamilton Group of New York to admit of a specific separation. It may be that if the ligamental area and hinge were known, differences of generic value would appear, but with the present knowledge of the shell this is not anticipated.

Formation and locality.—Lower Devonian, Lone Mountain, 18 miles northwest of Eureka, Nevada.

Genus MODIOMORPHA Hall.

Modiomorpha altiforme, n. sp.

Plate v, fig. 9.

Shell transverse, suboval to subquadrangular in outline. General surface strongly convex, with the umbonal ridge prominent.

Valves with small incurved beaks situated well towards the anterior end of the nearly straight cardinal line.

Surface, as shown by the impression left in the cast, marked by concentric lines of growth.

Dimensions: height, 4^{cm}; breadth, 6.5^{cm}; convexity of right valve, 17^{mm}.

Four specimens of this species have been obtained, all in the form of casts. The transverse subquadrangular form serves to distinguish it from *Modiomorpha alta* of the Hamilton Group of New York, which is the most nearly allied species. Some specimens that are referred to *M. alta* are almost identical in form, but the typical forms differ materially, as may be seen by comparing our figure with those given of the New York species (Pal. N. Y., vol. v, pt. 1, Plates and Explanations, pl. xxxvii).

Formation and locality.—Lower Devonian; Lone Mountain, 18 miles northwest of Eureka, Nevada.

Modiomorpha oblonga, n. sp.

Plate v, fig. 7.

Shell transversely elliptical or elongate-ovate. General surface moderately convex, with a distinct, rounded umbonal ridge.

Hinge-line shorter than the length of the shell and nearly straight. Beaks anterior, small, and incurved. Surface marked by concentric lines of growth.

Dimensions: height, 2.75^{cm}; breadth, 5.5^{cm}; convexity of left valve, 0.75^{cm}.

This species is more nearly related to *Sanguinolites ? Sanduskyensis* Meek (Pal. Ohio, vol 1, p. 209, pl. xviii, fig. 3), from the Helderberg Group of Ohio, than to any other species with which we are acquainted. It is less expanded posteriorly, and the anterior extremity is not as nasute. The generic reference is made on the general form, as the hinge characters are unknown.

Formation and locality.—Lower Devonian of Atrypa Peak, Eureka District, Nevada.

Modiomorpha obtusa, n. sp.

Plate iv, figs. 8, 8*a*.

Shell subrhomboidal in outline. General surface strongly convex, the umbonal ridge rounded. Hinge-line about one-half the length of the shell. Beaks small, incurved, and situated on the anterior third of the cardinal portion of the shell.

Surface marked by a few concentric lines of growth. Anterior muscular scar large, well defined; other interior characters unknown.

Dimensions: height, 1.5^{cm}; width, 2.5^{cm}; depth of right valve, 0.5^{cm}.

To some of the more transverse forms of *Modiomorpha quadrula* Hall (Pal. N. Y., vol. v, pt. 2, Plates and Explanations, pl. xli, figs. 18–26), this species bears a stronger resemblance than to any other form we know. It differs in the character of the umbonal ridge and the posterior extension of the shell.

Formation and locality.—Lower Devonian of Brush Peak, Eureka District, Nevada, and also at the same horizon on Lone Mountain, 18 miles northwest of Eureka, Nevada.

Genus GONIOPHORA Phillips.

Goniophora perangulata H.

Plate xv, fig. 10.

Sanguinolites perangulatus Hall, 1870. Prelim. Notice Lam. Shells, p. 35.
Goniophora perangulata Hall, 1883. Pal. N. Y., vol. v, pt. 1, Plates and Explanations, p. 12, pl. xxxiv, figs. 1–7.

In identifying this species a direct comparison was made between the specimens from Nevada and the type specimens from the Upper Helderberg Group of New York, at the New York State Museum of Natural History, Albany, N. Y. No variations of specific value were observed; the identification is further strengthened by the presence of *Pterinea flabella* and several species of Brachiopods, that are associated with the species at each locality.

Formation and locality.—Lower Devonian; Lone Mountain, 18 miles northwest of Eureka, Nevada.

Genus NUCULA Lamarck.

Nucula Rescuensis, n. sp.

Plate xv, fig. 9.

Shell small, broadly subovate, moderately convex; height to length as four to five; beaks not very prominent, about one-fifth the length from the broadly rounded anterior end; basal line broadly and uniformly curved; posterior end more sharply curved, and with the upper slope meeting the nearly straight hinge-line at an obtuse angle; posterior umbonal slope prominent and subangular.

Surface, in the cast, shows evidence of concentric lines of growth where the cast is very perfect, otherwise it is smooth.

Formation and locality.—Middle to Upper Devonian horizon; Rescue Hill, west of Rescue Cañon, Eureka District, Nevada.

Nucula, sp.?

Among the collections from Rescue Hill a number of casts of a larger species of Nucula than *N. Rescuensis* occur. Their form is much like that of *N. Niotica* of the Upper Helderberg Group of New York, but without some knowledge of the outer shell it is scarcely possible to determine whether it is that species, or a new form allied to some of the Devonian or Chemung species of New York.

Genus DYSTACTELLA Hall.

Dystactella insularis, n. sp.

Plate xv, fig. 8.

Shell transversely elongate-ovate, the length and height as two to one; valves moderately convex; anterior end contracted and sharply rounded at the extremity; basal line gently arcuate; posterior end somewhat broadly rounded, the extremity coming above a line drawn through the transverse center of the shell; cardinal line a little curved; beaks depressed.

Surface of cast marked by a strong anterior muscular scar; posterior scar not observed.

In general appearance this shell resembles a Nuculites or Palæoneilo, but it is without the clavicular ridge of the former and the faint muscular scars of the latter. In the presence of the strong anterior muscular scar, the somewhat nasute anterior end and the rounded up posterior extremity it is allied to *Dystactella subnasuta*, Hall (Pal. N. Y., vol. v, pt. 1, Plates and Explanations, p. 14, pl. li, figs. 28–31, 1883) from the Upper Helderberg rocks of the Falls of the Ohio.

Formation and locality.—Lower part of the Devonian limestone in the lower or central area of Gray's Cañon, Eureka District, Nevada.

Genus MEGAMBONIA Hall.

Megambonia occidualis, n. sp.

Plate v, fig. 1.

Outline subcircular. Length and breadth subequal. General surface strongly convex, with a convex anterior wing separated from the body of the shell by a well-marked, slightly curved sinus. Hinge-line shorter than the width of the shell.

Right valve unknown. Left valve with the beak depressed and curving forward over the cardinal line. Area and interior characters unknown.

Surface marked by strong concentric striæ and lines of growth; a few radiating lines are shown in the posterior half of the shell.

The most nearly related species is *Megambonia subcordiformis* Hall (Pal. N. Y., vol. v, pt. 1; Plates and Explanations, pl. lii, figs. 1, 8). The differences are the less elongate form and the character of the surface markings.

Formation and locality.—Lower Devonian; Lone Mountain, 18 miles northwest of Eureka, Nevada.

Genus NYASSA Hall.

Nyassa parva, n. sp.

Plate xv, figs. 14, 14*a*.

Shell small, transversely elongate, with the cardinal and basal margins subparallel, the posterior end being a little broader than the anterior; the width about twice the height; beaks moderately prominent and incurved, situated near the anterior end, which is rather abruptly rounded; basal line slightly sinuate midway; posterior end obliquely rounded, truncate above the lower third, rounding into the basal line and forming a very obtusely rounded angle with the cardinal margin; cardinal line nearly straight and declining towards the anterior end; umbonal ridge prominent, subangular, becoming more rounded toward the extremity of the posterior portion of the shell.

Surface showing a few lines of growth. Anterior muscular scar small, semicircular, and near the anterior margin; posterior scar subcircular, not strongly defined, situated on the postero-cardinal slope, near the margin.

This species resembles *Nyassa recta* Hall (Pal. N. Y., vol. v, pt. 1, Plates and Explanations, p. 14, pl. liii, figs. 1–8, 1883) of the Hamilton Group of New York, but differs in the outline of the valves and its less prominent beaks.

Formation and localities.—Lower Devonian; on the west slope of County Peak, Middle to Upper Devonian, at Rescue Hill, west of Rescue Cañon, Newark Mountain, and east side of Packer Basin, Eureka District, Nevada.

Genus GRAMMYSIA De Verneuil.

Grammysia minor n. sp.

Plate xv, figs. 15, 15*a*.

Shell very small, transversely elongate-ovate; valves ventricose; beaks strongly incurved, situated near the anterior end, which slopes abruptly from the beak with a slightly concave outline to the somewhat sharply rounded end that passes below into the basal line; this, with the exception of a slight sinuosity caused by the median or byssal groove, is transverse to where it rounds up slightly on the posterior margin to meet the oblique line of the upper postero-margin, with which it forms an obtuse angle, giving the posterior end of the shell a pointed appearance; cardinal line straight about two-thirds the length of the valve; umbonal ridge rounded or subangular, postero-cardinal slope abrupt.

Surface marked by rather strong, rounded concentric ridges and furrows that are nearly obsolete on the posterior umbonal slope.

Length of average size specimen, 12^{mm}; height, 7^{mm}.

This species is allied to the young shells of *Grammysia Hannibalensis* Shumard (Pal. N. Y., vol. v, pt. 1, Plates and Explanations, pl. lxi, figs. 23–33), but in the more anterior position of the beaks and small size it differs; it occurs at an horizon about 3,500 feet lower in the strata.

Formation and localities.—Upper portion of the Devonian limestone, on Rescue Hill, west of Rescue Cañon, and also at The Gate, northwest of Eureka, Nevada.

Genus SANGUINOLITES McCoy.

Sanguinolites? Combensis, n. sp.

Plate xv, fig. 16.

Shell very elongate, the length being about four times the height; moderately convex. Anterior end contracted and uniformly rounded on the lower portion, about one-sixth the entire length of the shell, measuring from the beaks; the nearly straight basal line is interrupted only by the sinuosity caused by the broad byssal furrow at the anterior third of its length; posterior end of the shell somewhat narrowed, terminating in a rather abruptly rounded extremity on the upper portion of the posterior outline; cardinal line straight anteriorly, becoming slightly arcuate on the posterior third.

Surface marked by numerous concentric lines of growth.

The generic reference of this species is somewhat provisional, as there is but one imperfect right valve in the collection, which, although strongly characterized, does not give the hinge structure, and other important features of value in generic determinations.

Formation and locality.—Lower Devonian, Combs Peak, Eureka District, Nevada.

Sanguinolites? gracilis, n. sp.

Plate iv, fig. 10.

Shell slender, elongate. General surface moderately convex, the upper margin reflected, forming a slightly concave lunette along nearly the entire length of the hinge, which is a little shorter than the length of the shell. Beaks small, near the anterior end and slightly incurved.

Surface nearly smooth, a few obscure lines of growth alone showing on the cast or matrix.

The anterior adductor muscular scar is of medium size, and has a low ridge and sulcus posterior to it that start near the beak and extend nearly to the basal margin.

Dimensions: height at anterior end, 1.75^{cm}; near posterior end, 2^{cm}; length, 11^{cm}.

This form differs from the preceding species in its more slender form, the absence of a well-defined byssal furrow, and the more attenuate anterior extremity.

Formation and locality.—Lower Devonian of Brush Peak, Eureka District, Nevada, and also at the same horizon on Lone Mountain, 18 miles northwest of Eureka, Nevada.

Sanguinolites rigidus W. & W. (Sp.)

Plate xvi, fig. 6.

Cypricardia? rigida White & Whitfield, 1862. Proc. Boston Soc. Nat. Hist., vol. viii, p. 300.
Edmondia? bicarinata Winchell, 1863. Proc. Acad. Nat. Sci. Philad., vol. xv, p. 13.
Sanguinolites rigidi Hall, 1870. Prelim. Notice Lam. Shells, p. 44.
rigidus Hall, 1883. Pal. N. Y., vol. v, pt. 1, Plates and Descriptions, p. 16; pl. lxvi, figs. 1–19.

The relative stratigraphic position of this species in the Chemung Group of New York and the Upper Devonian beds of The Gate, northwest of Eureka, is the same; and direct comparison with specimens from the Burlington sandstones of Iowa and the Chemung shales of New York, shows the two forms to be specifically identical.

Sanguinolites ? Sanduskyensis Meek.

Plate v, fig. 4.

Sanguinolites? Sanduskyensis Meek, 1871. Proc. Acad. Nat. Sci. Philad., vol. xxiii, p. 68. *Ibid.*, 1873. Geol. Surv. Ohio Pal., vol. i, pt. 2, p. 209, pl. xviii, fig. 3.
Compare *Modiomorpha linguiformis* Hall. Pal. N. Y., vol. v, pt. 1, Plates and Descriptions, p. 12, pl. xxxiv, figs. 15–17, and *M. Hyalea*, p. 13, pl. xli, fig. 28.

The external form and characters of the shell before me agree with those described by Mr. Meek, as shown in his figure.

In making an original generic reference, I would place the species under Modiomorpha, as it is more closely related to the genus as defined by Professor Hall (Prelim. Notice Lam. Shells, 1870. 8vo., pam., p. 72) than to Sanguinolites, as restricted by him to American species. For the present, Mr. Meek's provisional reference is retained.

Formation and locality.—Lower Devonian of Atrypa Peak, Eureka District, Nevada.

Sanguinolites ventricosus W. & W. (Sp).

Plate xv, fig. 13.

Orthonota ventricosa White & Whitfield, 1862. Proc. Boston Soc. Nat. Hist., vol. viii, p. 297.

Sanguinolites ventricosus Miller, 1877. Cat. Amer. Pal. Foss., p. 203.

Hall, 1883. Pal. N. Y., vol. v, pt. 1; Plates and Descriptions, p. 16, pl. lxvi, figs. 36–42.

The Nevada shell possesses all the specific characters of the examples of this species from the Burlington sandstone of Iowa, differing only in the more angular umbonal ridge, and not quite as expanded posterior end; features reduced or enlarged by the nature of the sediment in which the shells are embedded. A species referred to this from the Chemung Group of New York has sharp concentric lines instead of the more rounded lines of the Burlington species.

Formation and locality.—Middle to Upper Devonian, Rescue Hill, west of Rescue Cañon, Eureka District, Nevada.

Genus CONOCARDIUM Bronn.

Conocardium Nevadensis, n. sp.

Plate xvi, figs. 4, 4 *a*.

Shell small, cordate when viewed from the anterior end, and subtrigonal on a side view; anterior half ventricose, sloping away rapidly to the narrow posterior extremity and obliquely truncate anteriorly, the anterior slope being more or less concave below the rounded umbonal angle; beaks rising above the hinge-line, incurved; hinge-line straight, forming an angle of about 80° with the posterior, and 110° with the anterior, margin; hiatus not observed in the united valves, but from the outline of the single valve it was of medium width, and nearly one-half the length of the shell on the lower side.

Surface marked by fine radiating striæ on the body and anterior slope, and stronger striæ or ribs on the alate posterior portion of the shell; traces of fine concentric striæ are discernible, which under more favorable conditions of preservation would probably be a prominent feature.

This species is allied to a form from the Schoharie grit of New York, but with its short ventricose body, slender posterior extension, and rounded umbonal angle it differs from any described Devonian species known to me.

Formation and localities.—Lower Devonian horizon of Gray's Cañon, and Comb's Peak, Eureka District, Nevada.

Genus PARACYCLAS Hall.

Paracyclas occidentalis H. & W.

Lucina (*Paracyclas*) *elliptica*, var. *occidentalis*. Hall & Whitfield, 1872. Twenty-fourth Ann. Rep. N. Y. State Museum Nat. Hist., p. 189. Twenty-seventh, *ibid.*, pl. xii, figs. 14–16, 1875.

Paracyclas elliptica, var. *occidentalis* Hall. Pal. N. Y., vol. v, pt. 1; Plates and Explanations, p. 18, pl. lxxii, figs. 31–33.

The specific resemblance of the Nevada to the Ohio shell is so close that when placed in the same tray it is difficult to separate the two except by lithologic characters.

It has a much greater vertical range in Nevada than in Ohio, occurring near the base and the summit of the Devonian, and in Ohio only at the Upper Helderberg horizon.

Formation and localities.—Lower Devonian of Lone Mountain; Middle and Upper Devonian of Rescue Hill, west of Rescue Cañon, and at The Gate, northwest of Eureka, Nevada.

Genus POSIDONOMYA Bronn.

Posidonomya lævis, n. sp.

Plate iv, fig. 6.

Shell thin, broadly truncato-ovate. General surface depressed and but very slightly convex towards the beak on the rounded umbonal slopes.

Hinge-line straight, not quite as long as the greatest width of the shell. Beaks small, situated on the posterior portion of the anterior half of the shell, and nearly but not quite emarginate.

Surface marked by traces of a few concentric lines of growth. No interior characters have been observed.

Dimensions: height, 2.25^{cm}; breadth, 2.5^{cm}; convexity of right valve at the umbo, 2.5^{mm}.

In its smooth surface this species varies from typical examples of Posidonomya, but its straight hinge-line and general form ally it more nearly to that genus than to any other with which I am acquainted.

Formation and locality.—Lower Devonian of Atrypa Peak, Eureka District, Nevada, also at the same horizon on Lone Mountain, 18 miles northwest of Eureka, Nevada.

Posidonomya Devonica, n. sp.

Plate iv, fig. 7.

Shell thin, small, obliquely truncato-ovate. General surface very much depressed. Hinge-line straight. (Owing to the breaking away of the anterior portion this is not certain, but if any deflection from a straight line occurs it is very slight). Beaks small, situated near the cardinal margin at the anterior third of the distance between the posterior and anterior margins.

Surface marked by strong concentric lines that terminate on the straight cardinal line.

Interior and hinge characters unknown.

Dimensions: height, 14^{mm}; breadth, 13^{mm}; convexity of right valve, 1.5^{mm}.

This species occurs at the same locality as the preceding, but not in the same layer of rock. It differs in form and surface markings, in the latter feature more closely resembling the typical forms of the genus than *P. lævis*.

As with *P. lævis*, we know nothing of the hinge-line or interior characters, and have only the general form to go by in making the generic reference, which renders it more or less provisional and doubtful. Comparing this species, however, with ***Posidonomya Bronni*** Voltz, from the

Lias (Pictet. Traité de Pal., Atlas, pl. lxxxii, fig. 14), there is a striking resemblance.

Formation and locality.—Lower Devonian of Atrypa Peak, Eureka District, Nevada, and also at the same horizon on Lone Mountain, 18 miles northwest of Eureka, Nevada.

Genus MICRODON Conrad.

CYPRICARDELLA Hall.

Microdon (C.) macrostriatus, n. sp.

Plate v, fig. 5.

Shell transverse, broadly subovate. General surface depressed, very slightly convex. Hinge-line more than half as long as the shell. Beaks small and situated on the anterior quarter of the shell.

Surface marked by strong concentric lines of growth, seven in a distance of 12^{mm} on the central portion of the shell.

Dimensions: height, 2^{cm}; length about 4^{cm}.

In general form this species is not unlike *Microdon complanatus* Hall (Pal. N. Y., vol. v, pt. 1, Plates and Explanations, pl. lxxiv, figs. 14–19). The beaks are more anterior and the surface striæ more like lines or short, sharp undulations of growth than fine striæ.

The anterior half of the shell is preserved on one specimen, the outlined portion of fig. 5 being taken from another, in which the shell in front of the beaks is broken away.

Formation and locality.—Lower Devonian of Atrypa Peak, Eureka District, Nevada; also at the same horizon on Lone Mountain, 18 miles northwest of Eureka, Nevada.

Genus ANODONTOPSIS McCoy.

Anodontopsis amygdalæformis, n. sp.

Plate xv, figs. 7, 7 *a*, *b*.

General outline obscurely subtrigonal, moderately convex; slope from below the beaks to the anterior extremity slightly concave, and from this point, which is above the transverse center of the shell, the outline curves down into the broadly-rounded basal margin; posterior extremity a little below the transverse center and broadly angular, the line above rounding upward into the cardinal line and to the beaks with a uniform curvature; beaks elevated above the hinge-line, rather small, and situated on the anterior third of the shell.

Surface of cast with an obscure anterior muscular scar and obscure concentric lines of growth.

In the absence of the structure of the hinge the generic reference is accompanied with more or less uncertainty, but in the light that the present specimens afford the species is referred to the genus Anodontopsis.

Formation and localities.—Lower Devonian horizon of Lone Mountain, 18 miles northwest of Eureka; and Gray's Cañon, Eureka District, Nevada.

Genus SCHIZODUS King.

CYTHERODON Hall.

Schizodus (Cytherodon) orbicularis, n. sp.

Plate v, figs. 8, 8 *a*.

Shell of medium size; suborbicular, or subrhomboidal in outline. General surface strongly convex, with the umbonal ridge rounded. Beaks small and but little elevated above the cardinal line.

Surface smooth or marked by slightly impressed concentric lines of growth. Interior characters unknown.

Dimensions: height, 3^{cm}; breadth, 3.5^{cm}; convexity of right valve, $.75^{cm}$.

A small shell (fig. 8 *a*) still more quadrate in outline occurs in the Lower Devonian of Atrypa Peak. It is probable that it is a young shell of the species under consideration.

In *Cytherodon* (*Schizodus*) *quadrangularis* Hall (Pal. N. Y., vol. v, pt. 1, Plates and Explanations, p. 18, pl. lxxv, figs. 31–36), from the Chemung and Waverly Groups, we have the nearest form to *S.* (*C.*) *orbicularis.*

The beaks in the former are more subcentral and the outline less suborbicular. They are, however, very closely allied species.

Formation and locality.—Lower Devonian of Lone Mountain, 18 miles northwest of Eureka, Nevada.

Genus CYPRICARDINIA Hall.

Cypricardinia indenta Conrad (Sp.).

Plate v, fig. 14; pl. xv, fig. 11.

Cypricardites indenta Conrad, 1842. Jour. Acad. Nat. Sci. Philad., vol. viii, pt. 2, p. 244, pl. xii, fig. 12.
inflata Conrad, 1842. *Ibid.*, p. 246, pl. xv, fig. 2.
Cypricardinia inflata, var. *subequivalvis* Hall & Whitfield, 1872. Twenty-fourth Ann. Rep. N. Y. State Museum Nat. Hist., p. 189. *Idem*, Twenty-seventh Ann. Rep., 1875, pl. xi, figs. 2–4.
indenta Hall, 1883. Pal. N. Y., vol. v, pt. 1; Plates and Explanations, p. 19, pl. lxxix, figs. 6–23.

The Nevada specimens agree closely with those from New York and the Falls of the Ohio, no apparent variations occurring in a number of specimens except, it may be, in some young shells, a figure of one of which is given on plate v, fig. 14.

Formation and locality.—Lower Devonian of Atrypa Peak. Eureka District, Nevada.

GASTEROPODA.

Genus PLATYCERAS Conrad.

Of the eight species of Platyceras from the Lower Devonian horizon, five are identical with species of the Upper Helderberg Group of New York, viz: *Platyceras carinatum* Hall, *P. conicum* Hall, *P. dentalium* Hall, *P. nodosum* Conrad, and *P. Thetis* Hall (for descriptions and synonyms, see Professor Hall's beautiful monograph of the Devonian Gasteropoda of the State of New York, Pal. N. Y., vol. v, pt. 2, 1879), and three appear to be distinct from any described forms.

Platyceras Conradi, n. sp.

Plate xvi, figs. 1, 1*a*.

Shell strongly arcuate, the apex incurved, oblique, and resting against the right side of the body whorl; body whorl increasing very gradually in size from the inner whorl to the aperture; prominent on the back and somewhat flattened on the left side. Aperture varying from irregularly quadrate to subquadrangular; peristome sinuous and in some examples marked by a prolongation of the dorsal side and a strong sinus on the right posterior margin, which in other specimens is quite shallow and carried back on the posterior margin.

Surface, as shown by the cast, strongly striate, parallel to the margin of the peristome, and marked by undulations of growth on the body whorl.

This species is allied to *P. Thetis* Hall (Pal. N. Y., vol. v, pt 2, p. 8, pl. iii, figs. 11–16) in the general form of the body whorl, but differs widely in its more oblique, arcuate upper portion, a feature distinguishing it from *P. symmetricum* Hall (*loc. cit.*, p. 9, pl. iii, figs. 17–25) and other allied species.

Formation and locality.—Lower Devonian horizon of Comb's Peak, Eureka District, Nevada.

Platyceras nodosum Conrad.

Plate vi, figs. 5, 5 *a*, *b*.

Platyceras nodosus Conrad, 1841. Fifth Ann. Rep. Pal. State of N. Y., p. 56.
nodosum Hall, 1859. Pal. N. Y., vol. iii, p. 473, pls. cxv, figs. 1–6; cxvi, figs. 1–4.
dumosum and *P. dumosum*, var. *rarispinum* Hall, 1876. Pal. N. Y., Illustrations of Devonian Fossils, Gasteropoda, plates v and vii.
nodosum Hall, 1879. Pal. N. Y., vol. v, pt. 2, p. 17, pl. vii, figs. 4, 5.

We have very little hesitancy in identifying the species from Lone Mountain with specimens from the Oriskany sandstone of Knox, N. Y., and the figures of *P. nodosum* given by Professor Hall. The Nevada shell may expand a little more rapidly along the inner volutions, but of this there is scarcely any proof. The general form and nodose character of the surface vary little from the same features in the New York specimens; not as much as the specimens from the same locality vary from each other.

In New York the species ranges from the Oriskany sandstone to the Upper Helderberg Group. In Nevada it is as yet known only from the Lower Devonian in association with other Upper Helderberg species.

Formation and locality.—Lower Devonian of Lone Mountain, 18 miles northwest of Eureka, Nevada.

Platyceras undulatum, n. sp.

Plate vi, figs. 2, 2 *a*.

Shell small, depressed; apex incurved; body whorl expanding quite rapidly on the outer half of the volution; dorsum subangular and with a shallow depression on each side; a second rounded carina appears on the left side. The body volution is marked by concentric undulations that are slightly sinuous; on the dorsal carina a node appears at the crossing of the undulations. Aperture subcircular; peristome sinuate; the undulations corresponding to the outline of its margin.

Surface of shell unknown.

There is but one specimen of this species in the collections, but it is so well distinguished by its general form and the presence of transverse undulations that there is little danger of confusing it with other species. It is of the same type as *Platyceras Newberryi* Hall (Pal. N. Y., vol. iii, p. 333, pl. lxiii, figs. 14 *a–e*) of the Lower Helderberg Group, and the undulations in the cast may owe their origin to the presence of rows of nodes or spines on the shell.

Formation and locality.—Lower Devonian, Brush Peak, Eureka District, Nevada.

Platyceras thetiforme, n. sp.

Plate vi, figs. 4, 4 *a*, *b*.

Shell obliquely arcuate from the base with the apex incurved, the nucleus making about one volution; body whorl gradually increasing in size to the aperture; on the back it is strongly carinate; the left side is evenly rounded and the right a little flattened, producing a slight carina where uniting with the anterior surface.

Form of aperture unknown. Surface markings not determined. The strong carina on the back distinguishes this species from *P. Thetis* Hall, and its gradually expanding body volution, so much like that of *P. Thetis*, from *P. carinatum.*

Formation and locality.—Lower Devonian of Brush Peak, Eureka District, Nevada, in association with *Platyceras Conradi*, *Platyostoma lineatum*, etc.

Genus PLATYOSTOMA Conrad.

Platyostoma lineatum Conrad.

Platyostoma lineata **Conrad, 1842. Jour. Acad. Nat. Sci. Philad., vol. viii, p. 276, pl. xvii, fig. 7.**

Hall, 1876. Pal. N. Y., Illustrations of Devonian Fossils, Gasteropoda, pl. ix, figs. 1-21; *Idem.*, Pal. N. Y., vol. v, pt. 2, p. 21, pl. x, figs. 1-21, 1879.

The only differences to be noted between the Nevada shells and those of this species from the Upper Helderberg and Hamilton Groups of New York are, that the former average a little less in size and the surface cancellation, formed by the crossing of the revolving and concentric striæ, is almost obsolete; this latter feature, however, is frequently seen in specimens from both the New York formations.

Formation and locality.—Lower Devonian of Comb's Peak, Eureka District, Nevada.

Genus EUOMPHALUS Sowerby.

Euomphalus Eurekensis, n. sp.

Plate xvi, figs. 2, 2*a*.

Shell large, discoidal, lower side broadly umbilicate. Volutions four or more, nearly in the same plane, varying somewhat in different individuals; barely contiguous, gradually and uniformly expanding from the apex; section subcircular or transversely subovate, the diameters being as 4 to 5, to the outer portion of the last volution where there is a slight angularity developed on the upper, outer margin. Aperture slightly expanded, with a slight sinus on the upper margin.

Surface marked by concentric striæ parallel to the margin of the aperture.

The largest individual observed of this species has a transverse diameter of 80^{mm}, measuring across the volutions. The inner volutions have been decollated or removed during the maceration of the shell, leaving only the outer volution and one-half of the next preceding it, the termination of which rises slightly above the plane of the outer volution. A specimen 55^{mm} across the volutions has the spire depressed to the plane of the periphery of the outer volution, and in another it is still more depressed, the umbilicus being nearly flat.

Formation and localities.—Lower horizon of the Devonian limestone, Comb's Peak, and Atrypa Peak Ridge, Eureka District, Nevada.

Euomphalus (Phanerotinus) laxus Hall.

Plate vi, fig.3.

Euomphalus laxus Hall, 1861. Descriptions of New Species of Fossils, etc., p. 26.
1862. Fifteenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 54, pl. vi, fig. 2.
(*Ecculiomphalus?*) *laxus* Hall, 1876. Pal. N. Y., Illustrations of Devonian Fossils, Gasteropoda, pl. xvi, figs. 16–18.
comes Hall, 1876. *Ibid.*, pl. xvi, figs. 8, 9.
(*Phanerotinus*) *laxus* Hall, 1879. Pal. N. Y., vol. v, pt. 2, p. 60, pl. xvi, figs. 8, 9, 16–18.
Compare *Phanerotinus paradoxus* Winchell, 1863. Proc. Acad. Nat. Sci. Philad., vol. xv, p. 21.

The representatives of this species from the Upper Devonian are smaller than the average-sized specimens from the Hamilton Group of New York. In the disjoined volutions, broadly umbilicated under-side, gradual expansion from the apex, circular section, and concentric surface striæ, the species is identical with *E. laxus.*

It seems somewhat improbable that a form of this character should range from the Upper Helderberg and Hamilton Groups of New York up to the summit of the Devonian in Nevada, but with the large number of species which we know are common to the two localities and the identity in form between the shells of this species from each locality, there appears no other way than to place them under the same specific name.

There is a species associated with *E. laxus* that corresponds closely to *Euomphalus (S.) Hecale* Hall, (Pal. N. Y., vol. v, pt. 2, p. 59, pl. xvi, figs. 10–14), from the Chemung Group of New York and Pennsylvania, the difference being in the more rapid expansion of the outer volution. The specimens at hand are too imperfect for specific description.

Formation and locality.—Upper Devonian; The Gate, northwest of Eureka, Nevada.

Genus ECCULIOMPHALUS Portlock.

Eccuiliomphalus Devonicus, n. sp.

Plate vi, figs. 6, 6 *a*.

Shell discoid. Volutions, one or two?, widely separated; rapidly enlarging; section subtriangular, rounded a little above and also from the inner and outer margins down to the obtusely angulated ventral surface.

Surface unknown.

A comparison with the figures given by Portlock of the types of the genus *E. Bucklandi* and *E. minor* (Rep. Geol. Londonderry, Tyrone, &c., 1847, pp. 411, 412, pl. xxx, figs. 10–12) shows our Devonian species to be generically identical with them, although the inner portion of the whorl or whorls is broken away, and the surface of the shell destroyed.

Formation and locality.—Lower Devonian of Atrypa Peak; Eureka District, Nevada.

Genus STRAPAROLLUS Montfort.

Straparollus Newarkensis, n. sp.

Plate xvi, figs. 7, 7 *a*.

Shell small; spire slightly elevated above the general plane Umbilicus narrow, scarcely exposing the inner whorls. Volutions four or five, very gradually expanding to the outer volution, which increases a little more rapidly; transverse section rounded, subangular or obscurely subquadrangular; obtusely angular above and below with a slightly oblique, convex, or flattened periphery; gently rounded on the upper surface to the strongly defined suture, and on the lower surface to the more sharply rounded edge of the umbilicus.

Surface of the shell marked by concentric striæ and lines of growth parallel to the margin of the aperture. From the suture they curve slightly backward over the upper margin, and then forward to a little below the center of the periphery, recurving gently backward to the margin of the umbilicus.

This species is closely related to several described forms, but differs chiefly in having an unusually narrow umbilicus.

Formation and locality.—Central portion of the Devonian limestone; Newark Mountain, Eureka District, Nevada.

Genus PLATYSCHISMA McCoy.

Platyschisma? McCoyi, n. sp.

Plate xvii, figs. 1, 1*a*–*c*.

Shell subdiscoidal in its younger stages of growth, becoming more or less trochiform in the adult; spire moderately elevated. Volutions five or six, expanding gradually from the apex to the aperture; periphery rounded, acute; upper surface with a distinct depression just above the periphery, that increases in width with the enlargement of the volutions so as to give, in the adult, a concavity to the surface of the last volution; under side of volutions slightly convex; transverse section subrhombic. Aperture irregularly rounded with a sinuosity in the upper margin.

Surface marked by lines of growth that curve back to a narrow line or band, and then forward to the periphery of the whorl; on the last whorl these lines have a broad retral curve from the periphery to the umbilicus.

This species differs from the generic type of Platyschisma in having a closed umbilicus, and thick shell, but in the typical species the umbilicus is very small, and M. Chenu has placed a thick shell, *P. applanatus*,[12] as representing the genus. In other respects the generic characters are those of Platyschisma, the narrow line formed by the meeting of the striæ not forming a true band as in Pleurotomaria.

Formation and locality.—Central portion of the Devonian limestone; Newark Mountain, Eureka District, Nevada.

Platyschisma? ambiguum, n. sp.

Plate xvii, figs. 3, 3*a*.

Shell subdiscoidal, spire short, obtuse. Volutions about five, angular and closely united at the suture, forming a slightly convex, unbroken slope from the apex to the acute periphery; transverse section subtrigonal; upper surface with a slight depression below the center; under surface slightly convex. Umbilicus closed. Aperture nearly round, with the inner lip reflected.

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[12] Manual de Conchyliologie, p. 235, fig. 1382, 1859.

Surface transversely marked by lines of growth that have a retral curve on the central portion of the upper surface of the volution.

This species is doubtfully referred to Platyschisma, owing to its having a reflected inner lip and closed umbilicus. The latter, however, was probably open in the earlier stages of growth, having been closed by the outer volutions. The general aspect of the species is much like that of several forms of Pleurotomaria occurring in the Silurian formations, but the absence of a definite mesial band and the presence of the broad sinuosity in the upper portion of the aperture, shown by the retral curve of the lines of growth, distinguishes it and places its generic relations with Platyschisma or an allied genus.

Formation and locality.—Upper horizon of the Devonian limestone, The Gate, Eureka District, Nevada.

Genus CALLONEMA Hall.

Callonema occidentalis, n. sp.

Plate xvi, figs. 3, 3*a*.

Shell subglobose, depressed. Spire slightly elevated, consisting of about four rounded volutions very regularly increasing in size from the apex to the aperture; suture slightly depressed and marking the periphery of the preceding volutions.

Surface exfoliated. The cast shows a few obscure transverse striæ that curve gently backward from the suture towards the periphery.

The general aspect of this species is similar to that of *Callonema imitator* H. and W. (Hall, Pal. N. Y., vol. v, pt. 2, p. 53, pl. xiv, figs. 16, 17) of the Upper Helderberg Group of the State of Indiana. It differs in having a more depressed spire, and the volutions expanding a little more rapidly.

Formation and locality.—Lower horizon of the Devonian limestone, Comb's Peak, Eureka District, Nevada.

Genus LOXONEMA Phillips.

Casts of five species of spiral univalves occur in the lower fossiliferous beds of the Devonian limestone. They are in such a condition of preservation as to render it difficult in the absence of surface-markings to determine their relations, although they evidently belong to the genus Loxonema. Professor Hall met with a group of species in the Upper Helderberg Group of the State of New York in a similar condition, and assigned specific names to those differing widely in form and proportions from those already described so as to be distinguished by these characters alone. This course is the only one to pursue with such meager and unsatisfactory material when it is desirable to specify the different forms, and as this is the case with the Nevada species, two of the five are described and referred to Loxonema, and a descriptive note given with each of the remaining three, one of which is provisionally referred to *Loxonema subattenuata*, of the Upper Helderberg Group of New York.

Loxonema Eurekensis, n. sp.

Plate xvi, fig. 8.

Shell turretiform, elongate, robust; spire somewhat rapidly ascending, angle of divergence from the apex, 25°. Volutions, eleven or more in a specimen of 110^{mm} in length, slightly convex, and very gradually expanding from the apex.

Surface unknown.

Formation and locality.—Lower horizon of the Devonian limestone; divide at the head of the Reese and Berry Cañon, Eureka District, Nevada.

Loxonema nobile, n. sp.

Plate xvi, fig. 9.

Shell robust, elongate, turretiform; spire rapidly ascending, angle of divergence from the apex, 15°. Volutions regularly increasing from the apex, slightly convex; the three lower volutions have a united length of 50^{mm}.

This and the preceding species have slight indications of uninterrupted concentric lines of growth, so that the generic reference will probably be sustained on the finding of more perfect specimens. They are large, robust forms, differing very much from each other and from any described species occurring at the same geologic horizon.

Formation and locality.—Lower horizon of the Devonian limestone, Comb's Mountain, Eureka District, Nevada.

Loxonema ? subattenuatum Hall ?

Loxonema subattenuata Hall, 1861. Descriptions of New Species of Fossils, etc., p. 24. *Idem.*, 1862. Fifteenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 52. *Idem.*, 1876. Pal. N. Y., Illustrations of Devonian Fossils, Gasteropoda, pl. xiii, figs. 1–3. *Idem.*, 1879. Pal. N. Y., vol. v, pt. 2, p. 40, pl. xiii, figs. 1–6.

The illustrations of this species in the Paleontology of New York do not show the surface characters, which restricts the comparison to the casts; among these the differences between the two, *L. subattenuatum* and the Nevada form, are so slight as to make it impossible to separate them on good specific characters.

The species occurs at Comb's Peak, in the Lower Devonian, and at the same relative horizon in Gray's Cañon, Eureka District, Nevada.

Loxonema approximatum, n. sp.

Plate vi, fig. 7.

Shell, terebriform; spire rapidly ascending, volutions slightly convex, increasing regularly from the apex, the last one a little vertical; six in the length of 2½ inches from the base. Aperture subelliptical.

Surface as shown on the inner cast, marked by moderately strong, not closely arranged, longitudinal striæ that are nearly transverse to the volutions; the striæ arch backward very slightly.

The description of this species is nearly identical with that of *Loxonema styliola* Hall (Pal. N. Y., vol. v, pt. 2, p 48, pl. xiv, figs. 8, 9) from the Chemung Group of New York. It differs only in the more elongate form of the volutions and the presence of stronger surface striæ, as shown in the cast. The specific distinction is made on the difference in form of the volutions.

Formation and locality.—Lower Devonian of Atrypa Peak, Eureka District, Nevada.

Loxonema ? (sp. undt.)

Shell turretiform, elongate; angle of divergence from the apex, 13° to 15°. Volutions gradually enlarging, broad, moderately convex. Surface unknown.

This species is represented by a fragment preserving three of the lower volutions. It is distinguished by its elongate, tapering spire, and broad volutions, resembling in this respect *Loxonema nobile*, but differing in the greater convexity and form of the volutions.

Loxonema (sp. undt.)

Shell terebriform. Spire rapidly ascending; angle of divergence about 12°. Volutions narrow, rounded, gradually expanding. Surface obscurely shown by faint striæ, which bend slightly backward a little below the suture and make a gentle curve forward to the base of the volution.

This and the preceding species are associated with *Loxonema ? subattenuatum ?* and *Bellerophon perplexa*, in the lower fossiliferous horizon of the Devonian limestone of Gray's Cañon, Eureka District, Nevada.

Genus BELLEROPHON Montfort.

Of the six species represented in the collections from the Devonian limestone, two are undescribed and four are either identical with species described by Professor Hall, from the Devonian strata of the State of New York, or so closely allied to them that the grounds for a specific separation are not apparent in the specimens at hand. With a large number of more perfectly preserved specimens for comparison, it may be that some of the identifications will prove to be incorrect and to have been based on insufficient material.

Bellerophon perplexa, n. sp.

Plate xvii, figs. 6, 6 *a*, *b*.

Shell subglobose, the transverse and lateral diameters being 27^{mm} and 33^{mm}, respectively, in a medium-sized specimen. Volutions five or six, broadly rounded on the dorsum, subangular on the dorso-lateral angle of each volution, and sloping rapidly into the broad, open umbilicius from the dorso-lateral angle. Each volution embraces the dorsal surface of the preceding, leaving the entire umbilical slope of each exposed. The extreme transverse section of each volution is equal to four times the lateral section as it is measured midway, or at the carina. The aperture is probably similar in form to the transverse section of the last volution, as in a number of examples examined no evidence of any expansion was observed. The dorsum has a narrow, well-defined carina.

Test varying in thickness from .75^{mm} to 1.50^{mm}, with the variation in the size of the shell.

Surface marked by strong striæ; originating on the inner margin of the umbilical lobe they cross it obliquely, curving slightly and extending backward at an angle of 45° to the dorso-lateral angle over which they curve, retaining a backward slope of 15° to the dorsal carina.

The largest specimen in the collection has a transverse diameter of 50^{mm}. The test is removed from the outer portion of the last volution, the mold retaining only the slight dorsal carina, a feature that in another specimen is obsolete; this, however, is rarely the case as in most examples it occurs on the outer volution and may be traced on breaking away the volutions to the second or third, where the transverse diameter is five millimeters.

Formation and localities.—Lower horizon of the Devonian limestone, Comb's Peak, Gray's Cañon and Atrypa Peak, Eureka District, Nevada.

Bellerophon Combsi, n. sp.

Plate xvii, figs. 9, 9 *a*, *b*.

Form large, robust, subglobose; exterior shell unknown. In the cast the body volution is large, nearly if not quite concealing the inner volutions; broadly rounded on the dorsum and gradually expanding towards the transversely ovate aperture; a narrow dorsal carina is distinctly shown on the cast, and, very obscurely, traces of transverse striæ.

This is the largest of the several species occurring in the Devonian limestone of Nevada. Its length is 48^{mm}; transverse section midway of the outer volution 30^{mm}, near the aperture 45^{mm}.

Formation and locality.—Lower horizon of the Devonian limestone, Comb's Peak, Eureka District, Nevada.

Bellerophon lyra Hall (Pal. N. Y., vol. v, pt. 2, p. 113, pl. xxiii, figs. 1, 17–20).

A single specimen that corresponds in form and surface markings to this species occurs in the Devonian limestone on the eastern side of the District. It has been slightly worn by exposure to the weather, but not so much as to remove the fine, undulating, revolving striæ.

Bellerophon Leda Hall (Pal. N. Y., vol. v, pt. 2, p. 110, pl. xxiii, figs. 2–16).

The Nevada form is a little less flattened on the dorsum, and the dorsal carina is more prominent, as are the revolving striæ; this, however, is rather the result of a difference in the conditions of preservation than of absolute differences in the shells; the New York specimens usually occurring in the argillaceous shales or shaly limestones have suffered by compression.

Bellerophon Mæra Hall? (Pal. N. Y., vol. v, pt. 2, p. 119, pl. xxv, figs. 9–14; pl. xxvi, figs. 19–24).

A fragment from the higher beds south of The Gate has a thick test thickly studded with rows of pustules in a manner similar to that of *B. Mæra* of the Chemung Group of the State of New York. The general form of the volutions and dorsal carina also adds to the strength of the comparison

Bellerophon Pelops Hall? (Pal. N. Y., vol. v, pt. 2, p. 95, pl. xxii, figs. 7–13).

Associated with *B. Leda,* there is a form that corresponds to one of the varieties of this species from the Upper Helderberg limestone of the State of New York. The transverse striæ of the surface of the body volution bending backward towards the dorsal carina and the expanded aperture show in the Nevada specimen.

Genus SCOLIOSTOMA Braun.

Scoliostoma Americana, n. sp.

Plate vi, figs. 1, 1 *a–e*.

Shell small, cylindro-conical exclusive of the expanded inner lip of the aperture; apex obtuse; whorls five, slightly convex. Aperture contracted and turned obliquely outward and backward at right angles to the outer surface of the last whorl; outer lip somewhat thickened and rounded; inner lip expanded, extending up on to the whorls and directed outward; a swelling occurs opposite the outer lip that occupies its lower central portion; margin of inner lip very thin. Umbilicus concealed. Shell rather thick.

Surface of shell marked by a few concentric striæ of growth.

This is a most interesting form, as it is the first species of the genus from American rocks, and its occurrence in the Devonian limestones of Nevada is such that, when finding only a few fragments of the spire, we were led to consider it a land shell, the short, obtuse form recalling species of the genus Pupa.

S. Americana departs somewhat from the typical species *S. Dannenbergii* Braun 1838, (Neues Jahrbuch, Min. Geo. Geol. und Petrefak, p. 298, taf. ii, figs. B, 1–4) in having the aperture contracted and the inner lip more expanded, but there are no differences that appear to be of more than specific value.

Formation and localities.—Lower Devonian of Atrypa Peak, and Brush Peak, Eureka District, Nevada.

This species is associated with *Productus subaculeatus*, *Spirifera undifera*, *Atrypa reticularis*, *Goniophora perangulata*, *Platyceras dentalium*, *P. carinatum*, *Bellerophon perplexa*, etc.

Genus METOPTOMA Phillips.

Metoptoma ? Devonica, n. sp.

Plate xvii, figs. 2, 2 *a*.

Shell conical, broadly rounded or truncated at the posterior margin; uniformly rounded on the lateral and anterior margins; apex posterior and terminating within the margin; the slope from the apex is very slightly convex; height a little less than the postero-anterior diameter; test about 1^{mm} in thickness.

Surface markings obscured by the exfoliation of portions of the test and the adherence of the matrix; but strong, radiating striæ 1^{mm} distant from each other, and a few short undulations of growth, are shown on the postero-lateral faces.

Dimensions: height, 17^{mm}; length, 18^{mm}; breadth, 22^{mm}.

Formation and locality.—Lower horizon of the Devonian limestone; west side County Peak, Eureka District, Nevada.

PTEROPODA.

Genus TENTACULITES Schlotheim.

Of the four species of the genus Tentaculites now known to occur in the lower horizon of the Devonian limestone, three appear to be specifically identical with well-recognized species of the Lower Devonian of the State of New York, while the remaining form is distinguished only by the surface characters, which are often unreliable owing to the imperfect preservation of the test. This is illustrated by *Tentaculites gracilistriatus*, where, on the same block of limestone, specimens occur preserving the annulations and fine striæ, and others on which it is exceedingly difficult to determine either

The species are identified by comparisons with specimens from New York, and also with the beautiful illustrations and careful descriptions in the Paleontology of New York (vol. v, part 2).

Tentaculites gracilistriatus Hall (Pal. N. Y., vol. v, pt. 2, p. 173, pl. xxxi, figs. 12–14, and pl. xxxi A, figs. 37–47).

This neat and strongly defined species occurs in the greatest numbers and is the most widely distributed of the forms found in the Eureka District. It posesses all the characters given it by its author in describing the New York types; the variation in the form and prominence of the annulations, the solid apical portion devoid of annulations, and the crowded longitudinal striæ are the same in each, as also the general form and dimensions.

In New York it is associated with *Styliola fissurella*, a species that occurs with it at all the localities known in Nevada.

Tentaculites scalariformis Hall (Pal. N. Y., vol. v, pt. 2, p. 167, pl. xxxi, figs. 3–11).

The identification of this species is by the characters of the internal mold, the robust form, and the shape and regularity of the annulations. It has not been observed in association with *Styliola fissurella*, or other congeneric species.

Professor Hall states that this species has a geographic range of over 700 miles as known to him, being found in the strata of the Upper Helderberg limestone in New York, Ohio, and Indiana.

Tentaculites attenuatus Hall (Pal. N. Y., vol. v, pt. 2, p. 170, pl. xxxi, figs. 19, 20).

The Nevada specimens of this species are the same in the character of the surface markings and the irregularity of the annulations on the slender tube, but the species does not appear to have been as gregarious in habit as in the Hamilton Group.

Tentaculites bellulus Hall? (Pal. N. Y., vol. v, pt. 2, p. 169, pl. xxxi, figs. 15–18; and pl. xxxi A, figs. 48–51).

There occur in association with the preceding species a few specimens that are closely allied to *T. bellulus*. They have the same numerous, sharp, regular annulations and attenuate tube, but differ in being smaller, and in the absence of the surface markings mentioned by the author of the species.

Genus STYLIOLA Le Sueur.

Styliola fissurella Hall (Pal. N. Y., vol. v, pt. 2, p. 178, pl. xxxi A, figs. 1–30).

It does not appear to be possible to separate this minute form from the species as it occurs in New York. It ranges through the fossil-bearing Devonian limestone from the lower horizon at Lone Mountain to the highest beds at The Gate, northwest of Eureka, Nevada.

Styliola fissurella var. intermittens Hall (Pal. N. Y., vol. v, pt. 2, p. 177, pl. xxxi A, figs. 11–17.)

This elongate form is represented in the upper strata at The Gate, northwest of Eureka, Eureka District, Nevada.

Professor Hall, in speaking of *Styliola fissurella*, says:

"In its geographical distribution, the *S. fissurella* has a remarkable range, being known throughout the entire extent of the State of New York from east to west, a distance of more than 300 miles. It also occurs in the State of Indiana, which gives it a geographical extension of more than 700 miles in a direct line from its most easterly locality.

"In some of its phases it does not seem possible to separate this species from *Styliola clavulus* of Barrande by any external or internal characters thus far described or illustrated. The fossils are minute, smooth, or striated acicular tubes, presenting in all respects similar features and having similar associations, and they are of the same geological age in the two countries. In very numerous examples these fossils are striated transversely or longitudinally, and not unfrequently the two sets of striæ are visible on the same specimen. These are apparently only varieties of form and condition of the *Styliola fissurella*."

These latter remarks apply in full force to the specimens of this interesting species as it occurs in Central Nevada. Here it has the same associations and is of the same geologic age. It has not been discovered, as far as known, in the interval of 1,600 miles between its former known western extension in the State of Indiana and the present limit. This is, however, largely due to the few localities where the Devonian rocks are exposed to examination, and the fact that the great mass of Paleozoic strata west of the Mississippi Valley have been but partially examined by the geologist, and paleontologic investigation has been the result of hasty collecting rather than a systematic study of the fauna of any locality or horizon.

Formation and locality.—Upper Devonian limestone, Eureka District, Nevada.

Genus CONULARIA Miller.

Conularia (sp. undt.).

A single fragment was found in the lower beds at Comb's Peak, but not in a condition to determine its specific relations.

Genus HYOLITHES Eichwald.

Hyolithes, sp. (?)

Plate vi, figs. 8, 8*a*.

Form elongate, triangular, tapering regularly and gradually to an acute extremity. Transverse section subtriangular, slightly convex on the ventral side. Dorsal angle obtuse. Breadth and depth as two to one. Ventral face gently convex, arching slightly from the apex to the aperture. Dorsal face with a longitudinal concavity about equal to the convexity of the ventral face; strongly arched transversely. The aperture is not preserved, but was probably oblique, as in allied species.

Surface of shell unknown, as the only two specimens obtained are in the form of casts. This species is very closely allied, if not identical, in general form with *Hyolithes aclis* Hall (Pal. N. Y., vol. v, pt. 2, p. 197, pl. xxxii, figs. 22–30; pl. xxxii A, figs. 23–25) from the Hamilton Group of New York. The finding of specimens preserving the shell may show differences that are not now apparent, and for this reason no specific identification is attempted.

Professor Hall calls attention to the small number of species of Hyolithes in American Paleozoic strata as compared with other Paleozoic countries, and also the limited geographic range of the American species. All the collections made during the past few years from the Paleozoic formations of the Rocky Mountains and westward have offered no new well-determined forms, and but one species is known at present from above the Cambrian, or first, fauna Owing to the restricted range of the Devonian species of New York, we hesitate to identify this species with *H. aclis*, or to define it as a new species, until better specimens are collected.

Formation and locality.—Lower Devonian of Atrypa Peak, Eureka District, Nevada.

Genus COLEOLUS Hall.

Coleolus lævis, n. sp.

Plate vi, fig. 9.

Shell an extremely elongate, cylindro-conical, straight or slightly curved tube; section circular.

Surface of both the inner and outer walls smooth.

Dimensions: the largest tube obtained has a length of 11^{mm} and a diameter of 0.5^{mm}.

This species is closely allied to *Coleoprion ? Bohemicum* Barrande (Syst. Sil. Bohême., vol. iii, p. 109, pl. xv, fig. 15) from the Upper Silurian of Bohemia.

The surface characters of the Bohemian specimen are unknown, and we would hesitate in identifying a species of this character from the summit of the Devonian in Nevada with one from the Silurian of Bohemia even if more was known of each than is at present

The Nevada species was gregarious, the little slender tubes now lying thickly in the shale; some of them have a smooth, shining surface. The shell is rather thick.

Formation and locality.—Upper Devonian, White Pine shale, on the south slope of Diamond Peak, Eureka District, Nevada.

CEPHALOPODA.

Genus ORTHOCERAS Breynius.

Five species of Orthoceras are recognized among the numerous fragments from the lower horizon of the Devonian limestone. None of them, however, are sufficiently represented to be characterized as specifically distinct from described species, and their further determination, beyond a note of the characters of each, is deferred until more and better material is collected.

I. Shell robust, straight, elongate. Transverse section circular in uncompressed specimens. Apical angle about 15°, measuring the septate portion. Chamber of habitation and initial point unknown. Air-chambers numerous and shallow, having a depth of about 5^{mm} where the diameter is 25^{mm}. Septa thin, the concavity equal to the interspaces. Sutures gently curved, but not oblique to the axis. Siphuncle central; small at its insertion in the septa; its passage through the interseptal spaces has not been observed. Test removed from all observed specimens. There is a large fragment 45^{mm} in diameter, preserving three air-chambers, that is closely related to this form; the concavity of the septa is much greater, being 15^{mm}.

In some respects these fragments are allied to *Orthoceras Bebryx* Hall (Pal. N. Y., vol. v, pt. 2, p. 275), of the Hamilton and Chemung Groups of New York, but appear to belong to a distinct species.

II. This is a more slender form than the preceding, and diminishes less rapidly in receding from the chamber of habitation. Transverse section circular. Apical angle, 5° to 6°. Chamber of habitation large, without any constriction as far as observed. Air-chambers numerous, having a depth of 3^{mm} where the diameter of the tube is 13^{mm}. Septa thin, the concavity equal to a little less than the interspaces. Sutures transverse, straight.

The best preserved specimen is 60^{mm} in length, with a diameter at the septate end of 11^{mm}, near the mouth of the chamber of habitation of 16^{mm}, the chamber of habitation having a length of 35^{mm}. Surface characters unknown. This form is related to *Orthoceras exile* Hall (Pal. N. Y., vol. v, pt. 2, p. 290), of the Hamilton Group of New York.

III. This fragment has three septa in a length of 25^{mm}; transverse section slightly ovate, as 8 to 9; greatest diameter, 27^{mm}. Apical angle about 5°. Septa thin, with a concavity equal to the depth of the chambers Siphuncle eccentric, distant from the nearest point on the walls of the air-chambers about two-fifths the greatest diameter of the tube. The diameter at the septa is 2^{mm}, where the major diameter of the tube is 18^{mm}.

The greater depth of the air-chambers and the eccentric position of the siphuncle distinguish this from the preceding form.

IV. Several small fragments of an annulated species occur that are not unlike portions of small specimens of *Orthoceras Thoas* Hall (Pal. N. Y., vol. v, pt. 2, p. 261), of the Upper Helderberg Group. A specimen 7^{mm} in diameter has seven annulations in a distance of 21^{mm}. Septa and siphuncle not observed.

V. Large annulated form, 30^{mm} in diameter. Annulations narrow, depressed, with a broad, slightly-depressed area between them, five annulations in a distance of 30^{mm}. The margins of the septa appear about midway between the annulations.

There are also a number of elongate, slender tubes, the relations of which have not been determined. They are probably the young of one of the smooth-tubed forms.

Formation and localitities.—Devonian limestone; Comb's Peak and Lone Mountain, Eureka District, Nevada.

Genus GOMPHOCERAS Sowerby.

Gomphoceras suboviforme, n. sp.

Plate xvii, figs. 8, 8*a*.

Shell small, subglobose, attenuated towards the apex from the last chamber. Transverse section subcircular. The point of greatest transverse section of the grand chamber is a little anterior to the last septum. Tube expanding regularly, with the sides nearly straight up to the chamber of habitation, where it is somewhat inflated. Chamber of habitation rather large, with the slightly convex ventral and lateral faces sloping gradually to the apertural extremity, while the dorsal face, which is gently concave above the zone of greatest transverse section, is at right angles to the plane of the last septum.

Air-chambers numerous, regular, not perceptibly increasing in depth from where the tube is 10^{mm} in diameter to the chamber of habitation; average depth nearly 2^{mm}, or ten chambers in a distance of 19^{mm}. Sutures straight and horizontal. Siphuncle small, situated near the ventral margin; diameter 2^{mm}, where the ventro-dorsal diameter of the tube is 17^{mm}; its structural elements are unknown, as the cast shows only the diameter. Internal mold of the tube apparently smooth. Length of chamber of habitation (grand chamber), 18^{mm}; greatest diameter, 24^{mm}; length of tube, embracing ten air-chambers, 19^{mm}; anterior diameter of last chamber, 22^{mm}; of first apical chamber preserved in the specimen, 10^{mm}.

This species is distinguished from *G. oviforme* Hall (Pal. N. Y., vol. v, pt. 2, p. 344) of the Upper Helderberg Group of New York, by the more attenuated and less ovate form, and the uniform and more shallow chambers. It also resembles *G. raphanus* Hall (*loc. cit.*, p. 347), of the Hamilton

Group. The latter is more slender, and has a less gibbous chamber of habitation.

Formation and locality.—Upper horizon of the Devonian limestone; The Gate, northwest of Eureka, Eureka District, Nevada.

Genus CYRTOCERAS Goldfuss.

Cyrtoceras Nevadense, n. sp.

Plate xvii, figs. 7, 7 *a*.

This species is represented by a portion of the chambered tube 30^{mm} in length; the apical extremity, beyond a diameter of 10^{mm}, and the chamber of habitation having been broken away.

Shell small, regularly curved, the depth of the arc of curvature being 2^{mm} in a length of 30^{mm}. Transverse section subcircular. Apical angle of the lateral faces about 10°. Air-chambers numerous, varying in depth from 2^{mm} to 3^{mm} in a distance of 30^{mm}, the larger extremity having a depth of 17^{mm} and the apical section of 10^{mm}. Septa smooth, with a concavity a little less than the depth of the air-chambers. Sutures horizontal, with a slight backward curvature on the dorsal side. Siphuncle central. Test thin.

Surface marked by lines of growth that have a somewhat obtuse sinus on the ventral side. The internal mold preserves a trace of the exterior markings of the test.

This species resembles *Cyrtoceras* (*Gomphoceras*) *metula* Hall (Pal. N. Y., vol. v, pt. 2, p. 360), of the Upper Helderberg Group of New York. It differs in the central position of the siphuncle, apical angle, and curvature of the sutures.

Formation and locality.—Lower horizon of the Devonian limestone, Comb's Peak, Eureka District, Nevada.

Genus GONIATITES De Haan.

Goniatites desideratus, n. sp.

Plate xvii, fig. 10.

Shell discoid; estimating from the depth of the umbilicus, the thickness of the disk is about 10^{mm}. There were probably four volutions; two are preserved in the specimen before us, with a third partially shown; the outer ones embrace but little of the inner; they are somewhat flattened and apparently sharply rounded on the ventral lobe. Umbilicus wide, exposing all the inner volutions. The volutions enlarge very gradually until towards the outer portion of the last volution, or the grand chamber, where the expansion is slightly increased.

The entire dimensions of the chamber of habitation are unknown, as a portion is broken away and the latter septa are partially concealed by the test; the part remaining, however, indicates that it was large. Four septa are seen on the outer volution, obtained by cutting away a portion of the test; they are thin and uniform, curving a little forward on the umbilical margin and then gently curving backward, including a single broad, flattened lobe which occupies the entire width of the volution. Ventral lobe unknown. Test thin.

Surface marked by strong striæ and lines of growth that curve forward from the umbilicate lobe, crossing the direction of the septa at an acute angle near the umbilical margin and nearly at right angles on the outer portion of the volution.

This species differs in its wide umbilicus united with the direction of the surface striæ and septa from any form that has come within our observation.

Formation and locality.—Devonian limestone, Comb's Peak, Eureka District, Nevada.

CRUSTACEA.

Genus BEYRICHIA McCoy.

Beyrichia (Primitia) occidentalis, n. sp.

Plate xvii, figs. 4, 4 *a*.

Carapace large, Leperditia-like in outline, 4 5^{mm} in length by 2.75^{mm} in breadth; strongly convex; dorsal margin slightly incurved two-thirds the length of the valves and terminating anteriorly and posteriorly in obtuse angles formed by its union with the anterior and posterior margins; ventral margin gently curved to its union with the broadly rounded anterior and posterior margins. Two deep and slightly curved sulci penetrate the central dorsal region of the valve, terminating about three-fifths the distance across the valve from the dorsal margin; the posterior sulcus is narrow and curves backward, while the anterior is quite broad, with a forward curve, each having its origin on the dorsal margin as a faint groove and deepening with the convexity of the valve; this, united with the opposite curvature of the sulci, forms an elongate lobe or tubercle on the central dorsal portion of the valve; on casts of the carapace, and on valves where the two sulci are united by a slight sulcus at their lower termination, the size and appearance of the tubercle is greatly increased; a shallow groove occurs just within the anterior and posterior dorsal angles and extends a short distance down the anterior and posterior margins, where it becomes obsolete; two small, elongate nodes are situated near the dorsal margin, each a little within the anterior and posterior dorsal groove respectively; the surface of the nodes, the central lobe, and margins of the sulci are smoothly and evenly rounded.

Surface finely granulated, the granules arranged along minute, irregular striæ, or lines that radiate from the outer margins of the sulci to the anterior, posterior, and ventral margins.

The presence of the two sulci, as seen in all the adult individuals, properly refers this species to the genus Beyrichia. A study of a series of specimens, however, that pass from the largest size down to individuals 1^{mm} in length, shows that the posterior sulcus becomes more obscure with the decrease in size of the individual, and that when the shell is 1^{mm} in length the posterior sulcus is obsolete and a true unisulcate Beyrichia results that may be referred to the genus Primitia (plate xvii, fig. 4 *a*). The adult is a member of the corrugate group of Beyrichiæ, of which *Beyrichia Wilckensiana* Jones (Ann. and Mag. Nat. Hist., 2d ser., vol. xvi, p. 89, pl. v, figs. 17, 18, 1855) is the type, and the young form, of the "Simplices" of which *B.* (*Primitia*) *strangulata* (Salter) Jones (Ann. and Mag. Nat. Hist., 2d ser., vol. xvi, p. 171, pl. vi, fig. 18, 1855; *Ibid.*, 3d ser., vol. xvi, p. 416, 1865), or *B.* (*Primitia*) *simplex* Jones (Quart. Jour. Geol. Soc., vol. ix, p. 161, pl. vii, fig. 7) is the type.

Formation and localities.—Lower horizon of the Devonian limestone; Newark Mountain, Eureka District, and Lone Mountain, 18 miles northwest of Eureka, Nevada.

In the collections from the White Pine District, this species is found in the Upper Devonian of Telegraph Peak. The specimens all belong to the smaller variety in which the double sinus is almost obsolete.

Genus LEPERDITIA Roualt.

Leperditia rotundata, n. sp.

Plate xvi, fig. 5.

Carapace of medium size, 5^{mm} in length by 3.5^{mm} in breadth; convex, subovate in outline, with the anterior extremity a little narrower than the posterior; dorsal margin straight, about five-sixths the length of the valves; it terminates anteriorly and posteriorly in simple or slightly produced angles formed by its union with the anterior and posterior margins respectively; anterior and posterior margins broadly rounded; ventral margin regularly curved and on the right valve turned under, forming a rounded ventral edge to the carapace; ventral valve proportionally narrower than the right, and terminating in a plain edge on the ventral margin.

The uniform convexity of the surface is broken on the anterior and posterior dorsal angles by a slight groove just within the margin, and on the anterior dorsal region by a faintly-defined sulcus, indicating the position of the depressed eye-tubercle; muscular scar a little posterior to the center of the valve, as shown, on a large right valve, by its having a lighter color than the carapace.

Surface smooth to the eye, but minutely punctate under a strong magnifying glass.

Formation and locality.—Lower horizon of the Devonian limestone; southeast of Richmond Mountain, Eureka District, Nevada.

PŒCILOPODA.

Genus PHACOPS Emmerich.

Phacops rana Green (Sp.).

Calymene bufo, var. *rana* Green, 1832. Monograph Trilobites North America, p. 42.
Phacops rana Hall, 1861. Desc. New Species of Fossils, etc., p. 65. *Idem.*, 1862. Fifteenth Ann. Rep. N. Y. State Cab. Nat. His., p. 93.
Meek & Worthen, 1868. Geol. Surv. Ill., vol. iii, p. 447, pl. ii, figs. 1 *a–e*.
Nicholson, 1873. Pal. Prov. Ontario, p. 123, fig. 5, 6 *a*.
Hall, 1876. Pal. N. Y., Illustrations of Devonian Fossils, Crustacea, pl. vii, figs. 1–11; pl. viii, figs. 1–17.
Whitfield, 1883. Geol. Wisconsin, vol. iv, p. 339, pl. xxvii, figs. 17–19.
Compare *Phacops bombifrons* Hall. Pal. N. Y., Illustrations Devonian Fossils, Crustacea, pl. vi, figs. 18–29.

A comparison of specimens from the Hamilton Group of New York with those from Nevada shows variations that are quite strongly marked, but which are scarcely of specific importance, if we consider that the eastern form is imbedded in a shale and more or less compressed, while the Nevada examples are in a limestone, and have also undergone slight changes resulting from the differences in their original habitat as compared with the New York specimens. The glabella of the Nevada form is more inflated and protruded in front, a narrow furrow occurs between it and the eye, and the entire head is much more convex, but in one or two specimens these characters are reduced and a typical head of *Phacops rana* is shown. The species as seen in most of the specimens resembles, in its prominent glabella marked in the cast by the little elevations that filled the hollows of the pustules seen in the outer surface of the dorsal shell, *Phacops bombifrons*, and appears to be a species uniting the latter and *Phacops rana*.

Formation and localities.—Lower horizon of the Devonian limestone; Comb's Peak and other localities in the Eureka District; also at Lone Mountain, 18 miles northwest of Eureka, Nevada.

Genus DALMANITES Emmerich.[13]

Dalmanites Meeki, n. sp.

Plate xvii, figs. 5, 5 *a–c*.

Dalmanites (undt. sp.) Meek, 1877. Geol. Expl. Fortieth Parallel, vol. iv, p. 48, pl. i, figs. 11, 11 *a*.

The general form and the characters of the thorax are unknown, the description of the species being based on portions of the cephalic shield and entire specimens of the pygidium.

The glabella is subclavate, moderately convex, and separated from the fixed cheeks by a well-defined furrow; anterior lobe composing more than half of its entire area, transversely subovate, the length being two-thirds of the width; lateral furrows distinctly defined, deepest at the inner end; the anterior furrow extends obliquely forward and the two posterior pairs have a slight inclination backward; this gives to the anterior lateral lobe a narrow base and wider terminal portion, or a subtrigonal form to the lobe; the two posterior lobes are shorter and with their sides subparallel to each other. Occipital segment slightly rounded, almost flat on the upper portion in the cast, broadest at the center, narrowing slightly towards the dorsal furrows; occipital furrow strongly defined, arching a little forward at the center. Fragments of the fixed cheeks and palpebral lobe, with a free cheek found associated with them, show a large reniform eye situated opposite the anterior lateral lobe of the glabella with a deep furrow extending around its base; the slope from the eye to the shallow marginal groove is quite abrupt and gives considerable convexity to the head; the outer margin is of medium width, with a gentle slope outward.

Hypostoma subtriangular, as wide anteriorly as long, moderately convex; anterior margin gently curved; lateral margins contract quite rapidly at the anterior lateral angles and then converge regularly to the posterior extremity, where they converge very abruptly, forming an obtuse point which has several short spines or points along its lateral margins; a sulcus that rises on the lateral margin curves backward, and unites with its fellow at the center three-fourths the distance from the anterior to the posterior extremity; a broad shallow groove crosses anterior and subparallel to this, giving a lobed appearance to the posterior half of the hypostoma.

Thorax: A cast of a single segment is all that occurs associated with the other parts of this species; the median lobe is moderately convex and nearly transverse; lateral lobe curves outward and a little backward, terminating in a rather abrupt point; pleural groove deep, crossing the segment obliquely from the anterior margin to the posterior outer angle.

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[13] Dalmania, Emmerich, 1845; modified by Barrande to Dalmanites in 1852.

Pygidium moderately convex, subtrigonal in outline; length two-thirds of the width; anterior lateral angles a little rounded, lateral margins converge with a slight outward curve to the base of a strong upward-curving spine that forms the posterior extremity of the pygidum, the spine curving up at an angle of 45° in adult specimens and from 35° to 25° in the younger individuals; median lobe less convex than the lateral lobes and two-thirds as wide, uniformly rounded, and tapering gradually to the posterior extremity; marked by 13 to 15 well-defined annulations and an elongate terminal ring; lateral lobes with 10 to 11 strongly defined ribs that curve in their outer half obliquely backward, terminating just within the narrow margin.

Surface of the glabella, thoracic segments, and pygidium punctate.

This is the largest trilobite yet discovered in the Devonian of the West. Individuals 35^{cm} in length are indicated by the larger fragments, and one hypostoma is 7^{cm} in length.

The pygidium resembles that of *Dalmanites micrurus* of the Lower Helderberg limestone of New York (Pal. N. Y., vol. iii, p. 359, plate lxxiv, figs. 13–20), but differs in the less number of annulations in the lobe and in the punctate surface. To *D. anchiops* Green (sp.) (Pal. N. Y., Illustrations of Devonian Fossils, Crustacea, pl. ix) of the Upper Helderberg limestone of New York, it has a strong resemblance when compared to young individuals, but differences exist that readily separate the species.

The late Mr. F. B. Meek described and illustrated fragments of an unknown form of Dalmanites, from the Devonian limestone of the Piñon Range of Central Nevada, and the two pygidiæ illustrated are closely related to those from the Eureka District, the character of the surface, which is smooth or granulose, as seen in badly weathered specimens, alone appearing to be different.

The specific name is given as a slight recognition of Mr. Meek's extended and valuable contributions to our knowledge of the invertebrate Paleontology of the Western United States.

Formation and locality.—Lower horizon of the Devonian limestone, Comb's Peak, and on the divide at the head of the Reese and Berry Cañon, Eureka District, Nevada.

Dalmanites (undt. sp.).

At Comb's Peak a small and very perfect glabella of a species of Dalmanites was found. It is quite distinct from the associated *Dalmanites Meeki*, as the surface is finely granulose with larger granules irregularly interspersed; the determination of its specific relations is left until more material can be obtained.

Genus PROETUS Steininger.

Proetus Haldemani Hall.

Proetus Haldemani Hall, 1861. Descriptions of New Species of Fossils, etc., p. 74.
Haldemani Hall, 1862. Fifteenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 102.
Haldemani Hall, 1876. Pal. N. Y., Illustrations of Devonian Fossils, Desc. pl. xxi, figs. 7, 8, 9.

Of this species the glabella and pygidium were alone obtained. The glabella varies from that of *Proetus Haldemani* in being more compressed and the pygidium in having one or two less annulations in the median lobe; otherwise they appear to be identical.

Formation and locality.—Devonian limestone, Rescue Hill, west side of Rescue Cañon, Eureka District, Nevada.

Proetus marginalis Conrad (Sp.).

Calymene marginalis (?) Conrad, 1839. Ann. Rep. Pal. N. Y., p. 66.
Proetus marginalis Hall, 1861. Descriptions of New Species of Fossils, etc., p. 76.
marginalis Hall, 1862. Fifteenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 104.
marginalis Hall, 1876. Pal. N. Y., Illustrations of Devonian Fossils, Crustacea, pl. xxi, figs. 24–28.

We fail to discover, on a direct comparison of specimens of *Proetus marginalis*, from the Tully limestone of New York and entire specimens from Comb's Peak, any characters that would warrant the separation of the latter as a distinct species. The most prominent variation is in the width and outline of the border of the head, but on examining the figures given by Professor Hall, on plate xxi (Illustrations of Devonian Fossils), quite as wide a variation is shown between figs. 25 and 26 as between individuals from New York and Nevada. Continuing the comparison with

New York specimens of the genus, *P. clarus*, Hall, of the same work, plate xx, fig. 12, is nearly identical with the Nevada form, its greater width and less convexity distinguishing it, also a slight difference in the details of the border of the head, features that in many species of the genera Calymene, Asaphus, etc., are not of specific importance unless very strongly marked.

Formation and locality.—Lower horizon of the Devonian limestone; Comb's Peak, Eureka District, Nevada.

Genus PHILLIPSIA Portlock.

Phillipsia coronata Hall ?

Phillipsia ? (Brachymetopus ?) ornata Hall, 1876. Pal. N. Y., Illustrations of Devonian Fossils, Crustacea, pl. xxi, fig. 1 (Nat. P. ornata Portlock 1843).
coronata Hall, 1877. Cat. Amer. Pal. Foss., Miller, p. 221.

The central portion of the head is alone preserved in the specimen from Nevada; lateral compression has distorted its outline and convexity so that the comparison with the fragment from the Hamilton Group of New York, in which the glabella and frontal border is preserved, is necessarily imperfect, but from the close relations of the two, the species from Newark Mountain is for the present referred to *Phillipsia coronata.*

Formation and locality.—Middle horizon of the Devonian limestone; Newark Mountain, Eureka District, Nevada.

SUPPOSED EGGS OF THE TRILOBITE.

Numerous small, spheroidal bodies, one-half a millimeter in diameter, occur in the Devonian limestone of Lone Mountain in association with the fragmentary remains of *Phacops rana*, *Proetus marginalis*, and *Dalmanites Meeki.* In appearance they resemble the forms illustrated by M. Barrande,[14] which he considers the eggs of the trilobite. A careful examination does not lead me to make any other reference of them, as they answer very closely to what I would conceive as the ova of the trilobite, and their association with the remains of trilobites also favors this view.

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[14] Syst. Sil. Bohême, p. 276, vol. i, Trilobites, pl. xxvii, figs. 1-3, 1852.

FOSSILS OF THE CARBONIFEROUS.

A list of all the species known to occur in the Carboniferous formation of the Eureka District is given in the systematic catalogue at the end of this report, and only the rarer forms and new species are mentioned in the text. In some instances a species is partially identified by fragments, in which case the similarity to the described species is mentioned in the catalogue.

ECHINODERMATA.

Of this class, representatives of the Echinidea were obtained in the spines of two species, and of the Crinoidea in numerous segments of the columns of several species. As a whole the class is very imperfectly represented in the central portions of the Rocky Mountain area, and with the exception of a few species from Montana and New Mexico the great Crinoidal fauna of the Lower Carboniferous limestones of the Mississippi Valley is unknown in the Rocky Mountains. A further examination of the Lake Valley District in New Mexico, however, will undoubtedly add largely to the knowledge of the distribution of the Crinoidal fauna, as several species from there are identical with those from the Burlington limestone.

Since the above was written Mr. F. Springer (Amer. Jour. Sci., vol. xxvii, p. 97, 1883), has described a large and varied fauna from the Lake Valley District.

Genus ARCHÆOCIDARIS McCoy.

Archæocidaris, sp. ?

Two species are represented by the spines. One is very much like *A. Wortheni* Hall (Geol. Surv. Iowa, vol. i, pt. 2, p. 700, 1858), and the other approaches *A. Shumardana* Hall (*Ibid.*, p. 699) of the Lower Carboniferous limestone.

Formation and locality.—Lower portion of the Lower Carboniferous limestone on east slope of a small conical hill on the east side of Secret-cañon-road Cañon, Eureka District, Nevada.

BRACHIOPODA.

Genus DISCINA Lamarck.

Discina Newberryi Hall.

Plate xviii, figs. 3 (2, 2 *a*?).

Discina newberryi Hall, 1863. Sixteenth Ann. Rep. N. Y. State Cab. Nat. Hist., p. 30. Pal. N. Y., 1867, vol. iv, p. 25, pl. i, figs. 10 *a*, *b*, 11 *a–c*.
Discina (*Orbiculoidea*) *Newberryi* Meek, 1875. Pal. Ohio, vol. ii, p. 277, pl. xiv, figs. 1 *a–d*.

The Eureka shells present no features by which they can be distinguished from this species when directly compared with authentic specimens from the Waverly sandstones of Ohio.

At a little lower horizon a form of Discina occurs in a black shale that may belong to this species. All the specimens are more or less distorted by pressure. The two valves are shown by figs. 2, 2 *a* of plate xviii.

Formation and localities.—Lower portion of the Carboniferous Group, Richmond Mountain and on east slope of a small conical hill on the east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Discina nitida Phillips.

Plate vii, figs. 4, 4 *a*.

Orbicula nitida Phillips, 1836. Geol. of Yorkshire, pt. 2, p. 221, pl. xi, figs. 10–13.
Discina Missouriensis Shumard, 1860. Trans. St. Louis Acad. Sci., vol. i, p. 221 (as determined by Meek).
nitida Meek & Worthen, 1873. Geol. Surv. Ill., vol. v, p. 572, pl. xxv, fig. 1.
For description and synonomy, see Mon. Brit. Foss. Brach. Davidson, vol. ii, p. 197.

Well-marked examples of this species occur in the Lower Carboniferous limestone of Coal Hill, in the Pancake Range, and also on the west side of Mokomoke Ridge, White Pine Mining District, Nevada. This horizon is nearly equivalent to that in the Eureka District, where *D. Newberryi* is so abundant.

Discina connata, n. sp.

Plate vii, figs. 3, 3*a*.

Shell subcircular, a little more expanded in front than on the posterior portion.

The larger or upper valve is depressed conical with the apex below the greatest elevation of the shell and near to or on a line with the posterior margin.

Surface marked by concentric striæ and very delicate radiating lines, the latter showing more prominently on the interior of the shell.

The only interior markings shown are two long, slender, slightly elevated median ridges with a shallow depression between them.

Dimensions: width, 3^{cm}; elevation of upper valve, 8^{mm}. There are two specimens of the upper valve of this fine Discina in the collection, both of which have the apex nearly over the posterior margin. It may be that it is only a variety of *Discina nitida*, but with our present knowledge of the two forms a specific name is given to it.

Formation and locality.—Lower portion of Lower Carboniferous limestone in cañon directly south of a small conical hill on the east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Genus PRODUCTUS Sowerby.

Productus subaculeatus Murch.

Plate vii, fig. 2.

Synonomy: See descriptions of Devonian Brachiopods, *ante*, p. 128.

A direct comparison with the Upper Devonian specimens of this species shows that the Lower Carboniferous specimens are identical, although a belt of conglomerate 3,000 feet in thickness separates them in the geologic section.

The Carboniferous form is associated with *Productus Cora*, *P. semireticulatus*, *P. muricatus*, *P. elegans*, *Spirifera Rockymontana*, *S. camerata*, etc.

Formation and locality.—Lower portion of Lower Carboniferous limestone, in cañon directly south of a small conical hill on east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Genus SPIRIFERA Sowerby.

Spirifera trigonalis Martin (Sp.).

Plate xviii, fig. 11.

Conchyliolites anomites trigonalis Martin, 1809. Pet. Derb., tab. xxxvi, fig. 1.

Spirifer trigonalis Sowerby, 1820. Min. Con., tab. 265, fig. 1 (not 2 and 3).

Spirifera trigonalis, var. *a*, McCoy, 1855. Brit. Pal. Foss., p. 423.

trigonalis Davidson, 1858. Brit. Carb. Brachiopoda, p. 29, pl. v, figs. 25–34; 35–37?

bisulcata Davidson, 1861. *Ibid.* Mr. Davidson gives the synonomy up to the date of his publication, 1858, also that of *Spirifera crassa* De Koninck, *Spirifera grandicostata*, and *S. transiens* McCoy, which he regards as forms of this widely varying species.

Spirifer increbescens Hall, 1858. Geol. Surv. Iowa, vol. i, pt. 2, p. 706, pl. xxvii, figs. 6 *a–i*.

After a most careful study of a large series of specimens of this species, Mr. Davidson has united all the forms previously placed under the species mentioned in the list of synonyms as variations of a single very variable species and, in speaking of the winged, simple form and the transversely oval, rounded, thickened variety *crassa*, says: "The notion of both being the modification of a single species will, to the generality of observers, appear absurd; still if we find every variation connecting these extremes, are we to refuse the evidence of our eyes and senses, and to create as many species as we possess specimens?" An examination of Mr. Davidson's beautiful illustrations cannot fail to convince one of the specific relationship of the different forms, and I have no doubt that the Nevada shell before me is one of the varieties of this widely-distributed species.

In the Mississippi Valley it is found in the Chester limestone of the Lower Carboniferous formation of the State of Illinois, and described by Professor Hall as *Spirifera increbescens*. Mr. Davidson states that it is abundant in England, Ireland, and Scotland, and that on the Continent it is found in Belgium.

Formation and localities.—Lower portion of the Carboniferous Group, summit of Diamond Peak, and in the low hills at the mouth of Hayes' Cañon, Eureka District, Nevada.

Spirifera Leidyi N. and P.

Plate xviii, figs. 4, 4 *a*.

Spirifera Leidyi, Norwood & Pratten, 1855. Jour. Acad. Nat. Sci. Philad., 2d series, vol. iii, p. 72, pl. ix, figs. 2 *a–c*.
Spirifera bifurcatus, Hall, 1857. Trans. Albany Institute, vol. iv, p. 8.
Spirifera bifurcata, Whitfield, 1882. Bull. Amer. Mus. Nat. Hist., vol. i, No. 3, p. 47, pl. vi, figs. 13–15. In the remarks accompanying the latter reference, Mr. Whitfield considers *S. bifurcata* as a synonym of *S. Leidyi*.

The only mention of the occurrence of this species west of the Mississippi basin is found in a list of Carboniferous fossils from the Oquirrh Range, Utah, given in the second volume of the Geological Exploration of the Fortieth Parallel, page 447.

There appears to be little doubt of the specific identity of the Nevada shell with that from the typical locality in the Chester limestone of Illinois.

Formation and localities.—Lower portion of the Carboniferous Group, Richmond Mountain, and on the low hills south of the mouth of Hayes' Cañon, Eureka District, Nevada.

Spirifera annectans, n. sp.

Plate xviii, figs. 7, 7 *a*.

Shell below the medium size, somewhat inflated, length and breadth as 3 to 4, respectively; anterior and lateral margins forming rather more than a semicircle before uniting with the cardinal line, which is about three-fifths the breadth of the shell.

Ventral valve with a strongly defined mesial sinus extending to the extremity of the rather prominent, incurved beak; the bottom of the sinus is but slightly rounded and with a scarcely perceptible elevated line along the center; the sinus is bordered by a rounded rib, outside of which, on each side, there are four ribs, the outer almost obsolete on the smooth upper lateral slopes of the valve; area beneath the beak unknown, as it is concealed by the adhering matrix. Dorsal valve nearly as convex as the ventral; beak small, incurved, and projecting a little over the hinge margin; mesial lobe elevated, about as broad as the sinus of the opposite valve and with a slight median groove; lateral ribs, four on each side.

Surface of valves marked by fine concentric lines of growth.

This species is allied to *S. Leidyi,* but differs in the less number of ribs on the valves, and also in the rounded lateral angles.

Formation and locality.—Lower portion of the Carboniferous Group, Richmond Mountain, Eureka District, Nevada.

Spirifera neglecta Hall.

Plate xviii, fig. 10.

Spirifer neglectus Hall, 1858. Geol. Surv. Iowa, vol. i, pt. 2, p. 643, pl. xx, fig. 5.
neglectus Worthen & Meek, 1875. Geol. Surv. Illinois, vol. vi, p. 523, pl. xxx, figs. 1 *c*, 2 *a*.

This large and strongly-marked species of the Keokuk limestone of the Lower Carboniferous of Iowa and Illinois, is represented by single valves and one medium-sized entire shell. There appears to be a strong specific identity between the Nevada specimens and those from the Mississippi Valley.

Formation and localities.—Lower portion of the Carboniferous Group, Richmond Mountain, and on the east slope of a small conical hill on the east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Spirifera desiderata, n. sp.

Plate vii, fig. 8.

Dorsal valve subsemicircular in outline, extremities submucronate, moderately convex; mesial fold not very prominent and flattened across the top, well defined at the margins, and with a slightly depressed median line.

Surface marked by about thirty simple rounded plications, which are of moderate strength and little elevated; a few concentric lines are shown, but the exfoliation of the shell has destroyed any finer striæ that may have existed.

This is essentially a Devonian type, approaching such forms as *Spirifera Marcyi*, *S. macronata* (Pal. N. Y., vol. iv), in their dorsal valves; unfortunately there are no specimens of the ventral valve in the collections.

Formation and locality.—Lower portion of the Lower Carboniferous limestone in cañon directly south of a small conical hill on east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Subgenus SPIRIFERINA D'Orbigny.

Spiriferina cristata Schlotheim.

Plate xviii, figs. 12, 13.

Terebratulites cristatus Schlotheim, 1816. Beitr. z. Naturg. d. verst. in Akademie der Weissenschaften zu München, pl. i, fig. 3.

Spirifera octoplicatus Sowerby, 1827. Min. Con., p. 120, pl. 562, tables 2, 3, 4.

Spirifer octoplicata? Hall, 1852. Stansbury's Expd. Great Salt Lake, p. 409, pl. iv, figs. 4*a*, *b*. (Not *S. octoplicatus* Sowerby.)

Kentuckensis Shumard, 1855. Geol. Surv. Missouri, vol. i, pt. 2, p. 203.

Kentuckensis Hall, 1856. Pacific Railroad Rep., vol. iii, p. 102, pl. ii; figs. 10, 11.

spinosus Norwood & Pratten, 1855. Jour. Acad. Nat. Sci. Philad., vol. iii, p. 71, pl. ix, figs. 1*a–d*.

spinosus Hall, 1858. Geol. Surv. Iowa, vol. i, pt. 2, p. 706, pl. xxvii, figs. 5*a–c*.

Spiriferina octoplicata Davidson, 1862. Quart. Jour. Geol. Soc. London, vol. xviii, p. 29, pl. i, figs. 12–13·

Spirifera Kentuckensis var. *propatulus* Shumard, 1866. Trans. St. Louis Acad. Sci., vol. ii, p. 409.

laminosus Geinitz, 1866. Carb. und Dyas in Nebraska, p. 45. (Not *S. laminosus* McCoy.)

Spiriferina Kentuckensis Meek, 1872. U. S. Geol. Surv. Nebraska, p. 185, pl. vi, figs. 3*a–d*; pl. viii, figs. 11*a*, *b*.

spinosa? Derby, 1874. Bull. Cornell University, vol. i, pt. 2, p. 23, pl. vi, figs. 8, 13, 14.

Kentuckensis White, 1875. Expl. and Surv. West 100th Meridian, vol. iv, pt. 1, p. 138, pl. x, figs. 4*a–c*.

Characteristic specimens of this species occur in the lower and central portions of the Carboniferous rocks of the district, and in the upper strata they are associated with a form that is typical of *S. spinosa*, of the Chester limestone of Illinois. This same association also occurs at Coal Hill, in the

Pancake Range, where numerous examples occur that may be referred to either form, according as the spine bases are more or less prominent, or the shell contracted or extended laterally. On comparing these and specimens of each variety from the Mississippi Valley it seems impossible to avoid the conclusion that they are one and the same species.

Fig. 12, plate xviii, is taken from a Chester limestone specimen, and the adjoining fig. 13 from a specimen found in the Upper Carboniferous limestone of the Eureka District. Comparing these and also the specimens with Mr. Davidson's figures of *Spiriferina cristata* Schloth., 1816=*S. octoplicatus* Sowerby, 1827, it appears that we have another very variable species that has a great vertical range and an extended geographic distribution. Dr. White (Expl. and Surv. West 100th Merid., vol. iv, pt. 1, p. 140, 1875) regards *Spiriferina Kentuckensis* and *S. octoplicata* as distinct species, but with the evidence now accessible I should be inclined to consider them and also *S. spinosa* as varieties of one and the same species.

In the Devonian White Pine shale of the White Pine Mining District there is a form that in its plications is similar to *S. cristata*, and in surface markings it is very much like *S. insculpta* Phillips. It occurs at the summit of the Devonian, and is referred to *S. cristata*. Mr. Davidson has recognized the species in both the Middle and Lower Devonian (British Devonian Brachiopoda, p. 123).

Formation and localities.—In the Lower Carboniferous on the east slope of a small conical hill on the east side of Secret-cañon-road Cañon and in the Upper Carboniferous limestone of the western slope and foothills of Diamond Peak, Eureka District, Nevada.

Genus SYRINGOTHYRIS Winchell.

Syringothyris cuspidata Martin (Sp.).

Anomites cuspidatus Martin, 1796. See Davidson's Mon. Brit. Carb.Brach., p. 44, and supplement, vol. iv, p. 278, 1880.
Spirifer cuspidatus? Meek, 1877. Geol. Expl. Fortieth Par., vol. iv, p. 87, pl. iii, figs. 11, 11*a*.

Mr. Meek cites this species from above the Devonian of the White Pine Mountains, Nevada. It is quite abundant on Richmond Mountain in one stratum, in association with *Spirifera neglecta* and other Lower Carboniferous fossils, Eureka District, Nevada.

Specimens of *S. cuspidatus* have recently been received (1884) from the Lower Carboniferous limestone in the Little Belt range of mountains near Clendenin, Montana.

Genus RETZIA King.

Retzia radialis Phillips (Sp.).

Plate vii, figs. 5, 5 *a–h*.

Terebratula radialis Phillips, 1836. Geol. Yorkshire, vol. ii, p. 223, pl. xii, figs. 40, 41.
manticæ De Koninck, 1843. Anim. Foss., p. 287, pl. xix, figs. 4 *a–d*. (Not *T. manticæ* of Sowerby.)
Atrypa radialis McCoy, 1844. Syn. Carb. Foss. Ireland, p. 156.
Terebratula radialis De V. & De K., 1845. Russia and the Ural Mountains, vol. ii, p. 89, pl. x, figs. 9 *a*, *b*.
Retzia radialis Morris, 1854. Cat. Brit. Foss., p. 145.
Spirigerina ? radialis McCoy, 1855. Brit. Pal. Foss., p. 438.
Terebratula Mormoni Marcou. Geol. North America, p. 51, pl. vi, figs. 11 *a–c*.
Retzia punctilifera Shumard, 1858. Trans. St. Louis Acad. Sci., vol. i, p. 220.
Mormoni Meek & Hayden, 1859. Proc. Acad. Nat. Sci. Philad., vol. xi, p. 27;
Geinitz, 1864. Carb. und Dyas in Neb., p. 39, tab. iii, fig. 6.
subglobosa McChesney, 1860. Descriptions New Pal. Fossils, p. 45, and pl. i, fig. 1. Illustrations of same, 1865.
radialis Davidson, 1861. Mon. Brit. Carb. Brachiopoda, pp. 87, 218, pl. xvii, figs. 19–21; pl. li, figs. 4–9.
radialis Phillips, (sp.), var. *grandicosta* Davidson, 1861. Carb. Brach. Coll. in India, Quart. Jour. Geol. Soc., vol. xviii, p. 28, pl. i, fig. 5.
compressa Meek, 1864. Geol. Surv. California, Pal., vol. i, p. 14, figs. 7 *a–c*.
Kayser, 1882. Richthofen, China, vol. iv, p. 176, tab. xxii, figs. 1–4.
punctulifera McChesney, 1867. Trans. Chicago Acad. Sci., vol. i, p. 32, pl. i, fig. 1.
punctulifera Meek, 1872. U. S. Geol. Surv. Nebraska, p. 181, pl. i, fig. 13, pl. v, fig. 8.
Mormoni White, 1875. Expl. and Surv. West 100th Merid., vol. iv, pt. 1, p. 141, pl. x, figs. 7 *a–c*.
Compare *Retzia Marcyi* Shumard, 1854, Expl. Red River of Louisiana, p. 190, pt. 1, fig. 4 *a*, *b*; also, *Retzia Verneuiliana* and *R. vera* Hall, Geol. Surv. Iowa, vol. i, pt. 2, pp. 657, 704, 1858.

On bringing together a series of specimens of this species from Nevada and New Mexico it became at once apparent that it was very variable, and also specifically identical with the widely distributed *R. radialis*. All the specimens agree in general form, the presence of a small area and a vertically ribbed, punctate shell. In the number and strength of the radiating costæ, however, the greatest difference is shown. I now have before me specimens with 7, 10, 12, 13, 17, 22, and 25 costæ on each valve. With the two extremes to base a separation on both *Retzia Mormoni* Marcou, and *R. radialis*, var. *grandicosta* Davidson, appear as good species—one characterized by a few angular radiating ribs, and the other by numerous rounded radiating ribs. With the intermediate links to connect the shell with seven ribs and that of twenty-five and, also, any variations of form that occur among many examples, we are necessitated to unite all under one species, and to refer it to *Retzia radialis* of Phillips, as Davidson has shown that that species has the same range of variation in the number and character of the radiating ribs, and a comparison of the American specimens with his figures and descriptions leaves little, if any, doubt of the specific identity of the two.

In the White Pine shales of the Upper Devonian of the White Pine Mining District, Nevada, a shell occurs that is identical with the more finely-ribbed examples from the Lower Carboniferous limestone of the Pancake Mountains (situated between White Pine and Eureka) and those occurring at relatively the same horizon near Santa Fé, New Mexico.

As far as our observations go, the finely-ribbed variety appears first in the Upper Devonian, and the more coarsely ribbed in the Middle Carboniferous in association with the intermediate forms, uniting them with the finely-ribbed variety.

The coarsely-ribbed variety described by Davidson, from the Punjab, India, is represented by the Nevada shell bearing seven plications, and the more finely-ribbed form from Russia is the usual variety from England, Belgium, and America.

Dr. Kayser has placed the specimens representing the species in China under *R. compressa* Meek, a variety of *R. radialis* Phillips. All the differences mentioned by Meek as characterizing *R. compressa*, as distinct from *R. punctulifera*, are shown in a good series of *R. radialis*.

Retzia Marcyi Shumard is probably a finely-ribbed variety of *R. radialis*, and a large series of specimens may bring *R. vera* and *R. Verneuiliana* of the Lower Carboniferous limestone of Iowa into the same group as varieties.

As now known in Central Nevada, *R. radialis* ranges from the Upper Devonian through the Lower into the Upper Carboniferous limestone, a horizon equivalent to that of the Upper Coal Measures, where it is found in Nebraska, Illinois, etc. Its great geographic range has already been noticed in speaking of its occurrence in China, India, the Ural Mountains, England, and Western America.

Genus ATHYRIS McCoy.

Athyris hirsuta Hall.

Plate xviii, fig. 5.

Spirigera (*Athyris*) *hirsuta* Hall 1857.[15] Trans. Albany Institute, vol. iv, p. 8.
Athyris sublamellosa Hall, 1858. Geol. Surv. Iowa, vol. i, pt. 2, p. 702, pl. xxvii, fig. 1 *a–c*. *Idem.*, Derby, 1874. Bull. Cornell University, vol. i, No. 2, p. 10, pl. ii, figs. 9–12; pl. iii, figs. 15, 21, 29; pl. vi, fig. 16; pl. ix, figs. 5, 6.
Athyris hirsuta Whitfield, 1882. Bull. Amer. Mus. Nat. Hist., vol. i, p. 49, pl. vi, figs. 18–21.
Compare *Athyris Royssii*. See Brit. Foss. Brach. Davidson, vol. ii, p. 84.

There is so little difference between the examples of this species from Nevada and those from the Chester limestone of Illinois, that the lithologic features of the matrix alone distinguishes them. It is not improbable that this species is founded on a small variety of *Athyris Royssii*, and Mr. Meek has placed it as a doubtful synonym (Geol. Expl. Fortieth Par., vol. iv, p. 82).

Formation and locality.—Lower portion of the Carboniferous Group, Diamond Peak, in the Eureka District, and at Coal Hill, Pancake Range, Nevada.

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[15] The paper describing the Spergen Hill fossils was printed and copies distributed in 1857 in advance of the publication of Volume IV of the Albany Institute Transactions, which bears date 1858–1864.

Genus RHYNCHONELLA Fischer.

Rhynchonella Eurekensis, n. sp.

Plate xviii, figs. 8, 8*a–c*.

Shell below the average size; somewhat trigonal in outline; the width and height subequal, or the latter a little greater than the former; dorsal valve a trifle deeper than the ventral.

Ventral valve with a prominent beak and strongly marked but not deep mesial sinus that is about one-half the width of the shell at the front margin; sides sloping gradually away from the edges of the sinus and more abruptly from the somewhat elevated upper portion. Dorsal valve much more convex than the ventral and marked by a slight, broad mesial fold on the lower portion; beak strongly incurved; general surface rounding to the margins from the central portions of the valve.

Surface of the valves marked by from 40 to 50 round, simple plications.

This species is distinguished from any described by its general form and the numerous radiating plications.

Formation and localities.—Lower portion of the Carboniferous Group, east slope of a small conical hill on the east side of Secret-cañon-road Cañon, and on the northeast side of the cañon north of Pinto Peak, Eureka District, Nevada.

Rhynchonella Thera, n. sp.

Plate vii, figs. 6, 6*a–c*.

Shell small, subglobose or suboval, strongly convex, with a prominent mesial elevation and suture.

Ventral valve a little less convex than the dorsal, the greatest convexity being on the posterior half; below the middle a broad, not very sharply defined sinus begins, which becomes deeper and expands towards the front; beak imperforate and slightly curved over that of the opposite valve.

Dorsal valve most convex at the middle; the median fold is not usually strongly defined; it has a slight central sinus that reaches from near the beak out to the front termination of the fold, the latter starting about the center of the shell. Surface marked by fine concentric lines of growth.

This species is related by its form to *Athyris ? polita* Hall (Pal. N. Y., vol. iv, p. 293), of the Chemung Group of New York, and also in some of the specimens to *Athyris trinuclea* (see Bull. Amer. Mus. Nat. Hist., vol. i, p. 50), of the Lower Carboniferous of Indiana, etc.; the beak of the ventral valve, however, appears to be imperforate.

Formation and locality.—Lower portion of Lower Carboniferous limestone in cañon directly south of Conical Hill, on east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Genus CAMAROPHORIA King.

Camarophoria Cooperensis Shumard ?

Plate xviii, fig. 6.

Rhynchonella Cooperensis Shumard, 1855. Geol. Surv. Missouri, pt. 2, p. 204, pl. *C*, 4 *a–d*.

With the exception of having fewer plications, the Eureka specimens agree in all essential features with those from the Chouteau limestone of Missouri, as described by Dr. Shumard. A comparison of specimens may show the western form to be a distinct species, but the means of comparison at present available leads to referring them as above.

Formation and localities.—Lower portion of the Carboniferous Group, on the western slope of Richmond Mountain, and in limestone capping Diamond Peak, Eureka District, Nevada.

Genus TEREBRATULA Llhwyd.

Terebratula hastata Sowerby.

Synonymy: See Mon. Brit. Foss. Brach. Davidson, vol. ii, p. 11.

With a number of specimens to compare with Mr. Davidson's beautiful figures of this species we cannot find reasons for a specific separation of the American form from that of Europe. Some of the Eureka shells are a little more expanded in front, but scarcely more so than examples figured by Mr. Davidson.

Formation and locality.—Lower portion of Lower Carboniferous limestone in cañon directly south of a small conical hill, on east side of Secret-cañon-road Cañon, Eureka District, Nevada.

LAMELLIBRANCHIATA.

The occurrence of a number of species of this class in the Carboniferous Group, in the region of the Rocky Mountains, is unusual, as heretofore it has been but sparingly represented.

In 1852 Prof. J. Hall (Stansbury's Expedition to the Great Salt Lake, p. 412) described a few species, viz: *Avicula=Pseudomonotis curta, Tellinomya protensa* (probably belongs to the genus Modiomorpha), *Allorisma terminalis, Cypricardia occidentalis, Nucula arata.*

Of these the last three species were obtained from Eastern Nebraska or the Mississippi Valley region. To the first two may be added twenty-two species mentioned by different authors:

Marcou, J., 1858. Geology of North America, p. 44. *Myalina Apachesi.*

Meek, F. B., 1860. Preliminary Notice. 1876. Report Explorations Across the Great Basin of Utah, Simpson, p. 354. ***Aviculopecten Utahensis.***

White, C. A., 1874. Preliminary Notice. 1875. Explorations and Surveys West of the 100th Meridian, vol. iv, pt. 1, p. 146. ***Aviculopecten occidentalis, A. Coreyanus, A. McCoyi, A. ? interlineatus, Pinna peracuta?, Monopteria Marian, Myalina***, sp., ***M. ? Swallovi, Bakevellia parva, Schizodus Wheeleri, Allorisma subcuneata***, var. Also, in Appendix to Supplement of vol. iii of the same Survey, 1881, p. xxv. ***Myalina Permiana*** and ***Pleurophorus subcostatus.***

Whitfield, R. P., 1875. Carroll, Montana, to Yellowstone National Park, Ludlow, p. 143. ***Pinna Ludlovi.***

Meek, F. B., 1877. Geological Exploration of the Fortieth Parallel, vol. iv, p. 96. ***A. occidaneus.***

Two other species are described as from the Carboniferous, but they are more properly referred to the Devonian by Messrs. Hall and Whitfield.

Hall, J., and Whitfield, R. P., 1877. Geological Exploration of the Fortieth Parallel, vol. iv, p. 273. ***Aviculopecten Weberensis, A. curto-cardinalis, A. parvulus, Myalina aviculoides, M. Permiana, Sedgwickia ? concava, Cardiomorpha Missouriensis.***

The latter species, *Cardiomorpha Missouriensis*, although described from the Coal Measures of Missouri and Illinois, is, in Nevada, found in the strata at the summit of the Devonian and is not, there, a Carboniferous species; with this exception, all of the twenty-four species heretofore described are from the upper portions of the Carboniferous Group, usually referred by authors to the Coal Measures. From the latter horizon but one species is added, *Macrodon tenuistriata;* all the others from the Eureka District occur in the lower portion of the Lower Carboniferous limestone. The relations of the greater number of the species are with Devonian and Lower Carboniferous species rather than with those of the Coal Measure Groups of the Mississippi Valley.

Two species, *Macrodon Hamiltonæ* and *Grammysia arcuata*, belong to the Middle Devonian in New York, and *Grammysia Hannibalensis* and *Sanguinolites Æolus* occur in the Chemung and Waverly Groups.

Larger collections from the localities already known in the Eureka District will undoubtedly add materially to the number of species, if not genera, already described, as many fragments of unidentified forms occur in the collection; but with twenty-one genera, represented by forty-five species, to add to those already mentioned by the above authors, the Lamellibranchiata is fairly represented in the Carboniferous system of Nevada.

Genus AVICULOPECTEN McCoy.

Aviculopecten Haguei, n. sp.

Plate xix, fig. 4.

Shell large, oval or suborbicular in outline, exclusive of the ears; left valve depressed convex, hinge-line about three-fourths of the greatest width below; umbonal margins converging to the beak at an angle of 90°; lateral margins rounding into the regularly curved pallial margin; posterior ear larger than the anterior, less obtuse, and not so distinctly defined by the angle of the umbonal slope; the sinuses separating the ears from the lateral margins are shallow, the posterior being more broadly rounded than the anterior.

Surface of each ear ornamented by fine concentric striæ, and that of the posterior by 5 or 6 narrow, radiating costæ; in addition, the body of of the valve is marked by numerous rounded radiating costæ, that, towards the pallial margin, become subangular, with a quite broad interspace between them; the concentric striæ that are so marked on the ears are scarcely discernible except on the outer portions of the shell, owing to the imperfect state of preservation of the outer surface.

Dimensions: height, 9.5^{cm}; width, 8^{cm}; convexity of left valve, 1.25^{cm}.

This is an unusually large and strongly marked species, and unlike any described from this horizon.

Formation and locality.—Lower portion of the Carboniferous Group, east side of Secret-cañon-road Cañon, on the east slope of a small conical hill, Eureka District, Nevada.

Aviculopecten Eurekensis, n. sp.

Plate xix, figs. 2, 3.

General outline exclusive of the ears subovate, varying somewhat in different specimens. General surface moderately convex when not accidentally compressed; ears subequal in size, the posterior being the larger, the anterior shorter and more obtuse. Hinge-line less than the greatest width of the shell. Beak small, obtusely pointed.

Surface marked by from 18 to 25 simple lines or radiating costæ, that are crossed by fine concentric striæ. Left valve unknown. The hinge is smooth each side of the beak.

Dimensions: height of narrow form, 4^{cm}; of broad form, 3.5^{cm}; width, 3.5^{cm} and 4^{cm}; convexity of left valves, 1^{cm} and 0.75^{cm}, respectively.

This species is allied to *A. Haguei*, but differs in having about one-half the number of radiating surface costæ.

Formation and locality.—Lower portion of the Carboniferous Group, on the east slope of a small conical hill on the east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Aviculopecten peroccidens, n. sp.

Plate viii, fig. 8.

General outline, exclusive of the ears, suborbicular to subovate in the more elongate specimens. General surface rather strongly convex when not flattened by accidental compression. Anterior ear considerably smaller than the posterior. Hinge-line less than the greatest width of the shell below. Beak subcentral. Angle of divergence of the body of the shell from the beak, within the ears, 110°.

Surface marked by from 25 to 30 simple radiating costæ, the interspaces wider than the costæ, and with intercalated smaller costæ rising in some of them; concentric striæ and lines of growth are more or less distinctly shown. Right valve unknown.

The interior of the hinge unknown.

Dimensions: height and width of average size specimen, 3.5^{cm}; convexity of left valve, .75^{cm}.

This species shows considerable similarity to *A. Eurekensis.* It differs in the presence of a larger number of costæ and in its more orbicular form.

Formation and locality.—Lower portion of Lower Carboniferous limestone in cañon directly south of a conical hill on east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Aviculopecten Pintöensis, n. sp.

Plate viii, fig. 6.

Shell small, rounded ovate in outline exclusive of the wings. Left valve gently convex. Hinge-line about two-thirds as long as the greatest width of the shell below. Ears subequal in size, the anterior with a somewhat more deeply cut, rounded sinus beneath. Beak small, obtusely pointed and scarcely extending beyond the cardinal margin.

Surface marked by numerous fine radiating linear costæ, twenty in a distance of five millimeters, with a few finer striæ or costæ in some of the interspaces; the costæ are present on the ears and are strongly defined on the anterior ear; a few concentric lines of growth appear on the posterior ear and extend on to the disk of the shell as rather indefinite undulations or lines of growth.

Interior characters unknown.

Dimensions: height, 2^{cm}; width, 2^{cm}; convexity of left valve, 2^{mm}.

This pretty little shell is of the type of *Aviculopecten Coxanus* M. and W. (Geol. Surv. Ill., vol. ii, plate xxvi, fig. 6 *a*, *b*), differing only in its more erect form and shorter ears. In form it also approaches *A.* (*Pecten*) *plicatus* Sowerby, as figured by De Koninck (Anm. Foss., plate iv, fig. 6).

Formation and locality.—Lower portion of Carboniferous Group, in cañon north of Pinto Peak, Eureka District, Nevada.

Aviculopecten affinis, n. sp.

Plate xix, figs. 1, 1*a*.

Shell of medium size. Left valve, exclusive of the ears, suborbicular in outline, depressed convex; hinge-line varying from two-thirds to five-sixths of the greatest width below; posterior margin most prominent at the transverse center of the shell from where it curves gently and nearly perpendicularly downward to the somewhat abruptly rounded basal margin, and upward to the sinus beneath the ear; anterior margin most prominent above the center, from which it curves nearly as the opposite margin to the base, and above, more abruptly; ears subequal, subtriangular in form, and defined by a sinus that varies in depth and shape on different shells; beak subcentral, pointed, and extending above the hinge-line.

Surface of both ears and the body of the valve ornamented with numerous fine radiating costæ, every third or fourth one of which is raised above the intervening costæ, the latter usually running out before reaching the umbo; fine concentric striæ cross the radiating striæ on the ears and body of the valve, being more strongly marked on the anterior ear.

Right valve nearly flat, with a stronger sinus under the anterior ear, and the surface marked by numerous simple radiating striæ and concentric striæ on the ears.

An examination of many specimens in all conditions of preservation fails to show any crenulations on the hinge margin, although the interior is well preserved in several examples.

This species varies considerably in the outline of the valves; some are longer than wide and others with length and width subequal In the latter case the left valve is somewhat like that of *Crenipecten Winchelli* Meek, of the Waverly Group of Ohio. (See Pal. N. Y., vol. v, pt. 1, plate ix, figs. 1, 2, 4, 25–30.) The right valve, however, is finely but strongly striate longitudinally, while that of *C. Winchelli* is nearly smooth, except on the ears.

This is a very abundant species in two localities, almost filling some of the layers on the little conical hill on the east side of Secret-cañon-road Cañon, where it is associated with *A. Haguei*, *A. peroccidens*, and *A. Eurekensis.*

Formation and localities.—Lower portion of the Carboniferous Group with the preceding, and also on the west slope of Richmond Mountain, Eureka District, Nevada.

Aviculopecten, sp.?

Two other species of the genus are shown by rather large-sized shells, but their condition is such that the specific determination would be uncertain, and with the genus so well represented they are left for more material and future study to determine their specific relations.

Genus STREBLOPTERIA McCoy.

Streblopteria similis, n. sp.

Plate viii, figs. 4, 4 *a–d*, and plate xix, fig. 7.

Shell of medium size; outline, exclusive of the anterior ear, ovate; general surface depressed convex. The two valves are very much alike in convexity and form, except at the anterior ear and the slope beneath; the right valve has a deep, sharply-cut byssal sinus beneath the ear, the ear joining the body of the shell higher up towards the beak. The posterior ear is either very short and small, or obsolete, being merged into the flattened posterior umbonal slope. Hinge-line very short. Beaks small, the sides sloping away at an angle of about 80°.

Surface of the larger shells smooth or with fine concentric striæ and lines of growth; a few very indistinct fine radii are present towards the lower margin; the anterior ear of the right valve is marked by concentric lines of growth and rather strong radiating costæ; on the left valve the anterior ear has only the concentric striæ. On all the smaller shells the raised radiating striæ or fine costæ are present in varying degrees of distinctness up to well-marked striated forms that in surface characters apparently have no specific relation to the large, smooth shells

Dimensions: height of two examples, 3.75^{cm} and 1.75^{cm}; breadth, 3.25^{cm} and 1.5^{cm}; convexity of larger, 4^{mm}; of smaller, about 2^{mm}.

The peculiar obliquity of the valves, the deeply-cut sinus beneath the anterior ear of the right valve, and the smooth surface relates this species to *Streblopteria lævigata* McCoy (Brit. Pal. Foss., p. 482), the type of the genus. The form is also that of species referred to the genus Pernopecten, but in a large number of examples I have not been able to find the crenulated hinge area characteristic of that genus; the species agrees more closely with Streblopteria in other characters. The smaller shells resemble *Pecten ? pusillus* of the Permian (see Mon. Perm. Foss., England, p. 153), but differ in having a longitudinally striated surface.

Streblopteria tenuilineatus M. and W. (Geol. Surv. Ill, vol. ii, plate xxvi, fig. 9*a*) is the only American species that has been referred to the genus. It differs very materially in form and surface characters from the species under consideration.

Formation and localities.—Lower portion of the Carboniferous Group in the cañon north of Pinto Peak; on the west slope of Richmond Mountain, and in the cañon south of a small conical hill on the east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Genus CRENIPECTEN Hall.

The genus Crenipecten is described by its author as "Like Aviculopecten in form, hinge furnished with a series of small cartilage pits throughout its entire length." Example, *Crenipecten Leon* and *C. crenulatus* (Pal. N. Y., vol. v, pt. 1, 1884).

The study of the species referred to Aviculopecten from the Eureka District shows but one species that has such a hinge. *A. affinis*, *A. Eurekensis*, *A. peroccidens*, *A. Haguei* have a flattened hinge, but in none of the examples of those species have we detected any vertical ligamental pits as in Crenipecten.

Crenipecten Hallanus, n. sp.

Plate viii, figs. 7, 7*a–c*.

Shell rather above medium size; outline, exclusive of the ears, suborbicular. General surface moderately convex. Hinge-line and greatest width of the shell as 4 to 5; 5 to 6 in two examples. Anterior ear smaller than the posterior, and also with an abruptly curved sinus beneath it. Beaks small and abruptly pointed, subcentral in position on the hinge-line.

Surface of both right and left valves marked by linear, radiating, raised striæ that increase in number towards the margin by the striæ originating in the gradually widening interspaces between the initial striæ, the striæ at the basal margin being about 1^{mm} apart. Fine concentric striæ cross the radiating elevated striæ or costæ.

The left valve of this species is closely allied to that of *Crenipecten Winchelli* (see Pal. N. Y., vol. v., pt. 1, p. 89), except in being more robust. In the right valve marked differences occur in the surface characters and the shape of the anterior ear. With *Aviculopecten affinis* it is more closely related, differing mainly in the form and proportion of the ears, in its more robust form, and the presence of the ligamental pits on the hinge-line, which, as yet, have not been observed in the latter, although the conditions for their preservation and discovery appear to be much better than in *C. Hallanus*.

Formation and localities.—Lower portion of the Lower Carboniferous Group in the cañon north of Pinto Peak, and also on the east slope of a small conical hill on the east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Genus PTERINOPECTEN Hall.

Pterinopecten Hoosacensis, n. sp.

Plate viii, fig. 9.

Outline truncato-ovate. Left valve depressed convex. Hinge-line nearly as long as the greatest width of the shell below. Anterior ear defined by a strong rounded sinus; posterior ear scarcely more than a slight extension of the postero-lateral portion of the shell. Beak small, abruptly pointed, and situated a little anterior to the center of the hinge-line.

Surface marked by a few concentric lines of growth and fine, linear, raised striæ that increase in number by intercalation as the initial striæ spread apart, the intercalated striæ appearing between them.

Dimensions: height, 4.5^{cm}; breadth, 4.75^{cm}.

In outline this species is not dissimilar from *Pterinopecten* (*Pecten*) *papyraceus*, as illustrated by De Koninck (Anm. Foss., plate v, figs. 6, 6 *a*, *b*). It differs widely in surface characters. I know of no American species with which to compare it.

Formation and locality.—Lower portion of the Carboniferous Group, on the east slope of a small conical hill on the east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Pterinopecten Spio, n. sp.

Plate viii, figs. 1, 1 *a*.

Outline, including the ears, broadly truncato-ovate. Left valve depressed convex. Hinge-line nearly as long as the greatest width of the shell below. Anterior ear small, separated more sharply from the body of the shell than is usual in the genus; sinus rounded; posterior ear large and not very distinctly separated from the body of the shell. Beak small, abruptly pointed, and situated nearly on the anterior third of the length of the hinge-line.

Surface marked by about 20 linear, radiating costæ, with inter-spaces greater than the width of the costæ, in which faintly-defined costæ are sometimes shown; concentric lines of growth occur, and under peculiar conditions of preservation, as shown in fig. 1 of plate viii, form a reticulated structure with the radiating costæ.

Dimensions: height of an average specimen, 15^{mm}; width, 18^{mm}; convexity of left valve, 2^{mm} to 3^{mm}.

In outline and the form of the wings this species approaches that of *Pterinopecten exfoliatus* Hall, of the Devonian of New York (Pal. N. Y., vol. v, pt. 1, p. 61, 1884), more nearly than to any other species known to me.

Formation and locality.—Lower portion of Lower Carboniferous limestone in cañon directly south of a small conical hill on east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Genus PTERINEA Goldfuss.

Pterinea Pintöensis, n. sp.

Plate xix, fig. 10.

Shell very small; body part obliquely elongate, narrowing towards the beak, which extends a little above the hinge-line. The anterior ear is small, rounded in front, and somewhat compressed; posterior ear large, compressed, extending beyond the posterior extremity of the valve, pointed at the end, and slightly sinuous behind. The body of the valve ranges at an angle of about 40° with the cardinal margin.

Surface marked by strong concentric striæ.

This little shell has a length of 10^{mm} on the cardinal line and a height at right angles to this of 6^{mm}. It is unlike any species known to me occuring at this horizon.

The generic reference to Pterinea is made in the absence of any knowledge of the interior characters. It is very probable that it belongs to the genus Actinopera, but with the material at hand this cannot be determined.

Formation and locality.—Lower portion of the Carboniferous Group, on northeast side of cañon north of Pinto Peak, Eureka District, Nevada.

Genus LEPTODESMA Hall.

Leptodesma, sp. ?

Two species of this genus are represented in the collections from the lower portion of the Carboniferous. One is quite strongly marked, and is allied to *Leptodesma Rogersi* Hall, of the Hamilton Group of New York, and the other to *L. complanatum* Hall, from the Chemung Group, New York (See Pal. N. Y., vol. v, pt. 1, pp. 176, 227). Each is represented by a single, not very well-preserved specimen, which renders a specific identification very uncertain and unsatisfactory.

Genus PTYCHOPTERIA Hall.

Ptychopteria protoforme, n. sp.

Plate viii, fig. 5.

Shell obliquely elongate, narrowing anteriorly; posterior ear broad and straight, anterior ear short; beak anterior, obtusely rounded; hinge line long, but not quite equaling the greatest width of the shell below.

Surface marked by obscure lines of growth.

Interior characters unknown.

Dimensions: height, 12^{mm}; greatest breadth, 20^{mm}; convexity of left valve, 2^{mm} to 3^{mm}.

The outline of this species is more nearly like that of *Ptychopteria Proto* Hall (Pal. N. Y., vol. v, pt. 1, p. 129, 1884) than that of any other species known to me. The ear is not as broad, and it also terminates in a more acute angle with the hinge-line, in this respect resembling *P. sinuosa* Hall (*loc. cit.* p. 130).

Formation and locality.—Lower portion of Lower Carboniferous limestone on east slope of a small conical hill on the east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Genus PINNA Linnæus.

Pinna inexpectans, n. sp.

Plate xix, fig. 11.

Shell elongate, lanceolate, over four times longer than wide; section elliptical, valves not very convex; ventral and dorsal margins straight or slightly convex. The dorsal or cardinal margin is a little thickened and with a well-defined rounded rim at the edge.

Surface marked by strong ridges subparallel to the dorsal and ventral margins; they are more or less flexuous, and while obsolete on the upper portion of some examples, are present on the entire width of the shell in others. A few obscure concentric lines, parallel to the posterior margin, cross the radiating plications.

This species is allied to *Pinna Missouriensis* Swallow (Trans. St. Louis Acad. Sci., vol. ii, p. 97, 1863), but from the description of that species it appears to differ in form and surface markings. It differs from *P. flexicostata* McCoy (Brit. Pal. Foss., p. 499), in being more elongate, and also in having the radiating plications on the entire lower half of the valves.

Formation and locality.—Lower portion of the Carboniferous Group, on east slope of a small conical hill on the east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Pinna consimilis, n. sp.

Plate xx, fig. 13.

Valves elongate, about three and one-half times longer than the width at the posterior end; the upper and lower margins converging at an angle of 20° towards the beaks, where the shell is pointed and subcylindrical, the section becoming more and more elliptical toward the posterior end, which is slightly and obliquely rounded; cardinal margin a little thickened and with a narrow, well-defined, rounded rim or cardinal ridge.

Surface marked by concentric lines of growth; otherwise smooth.

The description is drawn from a small specimen 11^{cm} in length, but fragments of individuals of twice the size were found. The species is allied to *P. spatula* McCoy (Brit. Pal. Foss., p. 499), but differs in being less elongate in proportion to the width, the outline being more that of the plicated species, *P. flexicostata* McCoy (*loc. cit.*, p. 499). I know of no closely related American species, *P. subspatulata* Worthen (Geol. Surv. Ill., vol. vi, p. 524), being a much more elongated form.

Formation and localities.—Lower portion of the Carboniferous with the preceding species, and also on the northeast side of the cañon north of Pinto Peak, Eureka District, Nevada. Also at about the same horizon on the west slope of Mokomoke Ridge, White Pine District, Nevada.

Genus MYALINA De Koninck.

Myalina congeneris, n. sp.

Plate xix, fig. 6; plate xxii, fig. 10.

Shell oblong, the height being twice the width even in the broad examples; hinge line straight and ranging at an angle of 60° with the nearly straight anterior margin; base narrow, but rather broadly rounded, posterior very broadly rounded, curving slightly inward towards the cardinal line. General surface of the valves strongly convex towards the front border, and beaks becoming more depressed on the posterior portion. Surface of both valves marked by slightly imbricated lamellæ of growth.

The specimen illustrated is more narrow than a right valve associated with it that has all the essential characters of the species. Its specific relations are with *Myalina angulata* M. and W. (Geol. Surv. Ill., vol. ii, p. 300), from which it differs in having a more obtuse angle at the union of the cardinal and anterior margins and a less oblique anterior margin. It is in outline intermediate between *M. angulata* and *M. subquadrata* Shumard (Geol. Surv. Missouri., vol. i, pt. 2, p. 207, 1855); *Myalina Apachesi* Marcou (Geol. N. Amer., p. 44) may possibly be a closely allied species, but with the description and figure given by its author this cannot be determined. Compare, also, *M. St. Ludovica* Worthen (Geol. Surv. Ill., vol. v, p. 540).

Formation and locality.—Lower portion of the Carboniferous Group, on the west slope of Richmond Mountain, Eureka District, Nevada.

Myalina Nemesis, n. sp.

Plate xix, fig. 5; plate xxii, fig. 7.

Shell subovate to subquadrangular, depressed convex, base broadly rounded; anterior margin slightly concave or straight, posterior outline broadly rounded and meeting the hinge-line at an obtuse angle. Hinge straight, shorter than the greatest width, and ranging at nearly right angles to the longitudinal axis of the shell. Beaks terminal and directed obliquely forward.

Surface marked by concentric undulations of growth.

The original type of this species is the elongate compressed left valve illustrated on plate xix, fig. 5. Subsequently several specimens of the right valve were obtained from the same locality that show more nearly the true outline of the shell. The hinge-line varies in length, as do the relative proportions of the height and width of the valves, but these differences do not prevent the union of the several examples under one species.

In outline some of the shells approach *Myalina ampla*, M. and H. (Name proposed in description of species, Pal. Upper Missouri, p. 33).

Formation and locality.—Lower portion of the Carboniferous Group in the cañon northeast of Pinto Peak, Eureka District, Nevada.

Myalina Nessus, n. sp.

Plate xxii, figs. 8, 8*a*.

Shell large, subquadrate, narrowing towards the base, higher than wide, compressed posteriorly, becoming somewhat convex on the umbonal slopes. Hinge straight, fully equalling, if not exceeding, the greatest width of the valves, and ranging at nearly right angles to the vertical axis of the shell. Beaks terminal and directed obliquely forward.

Surface marked by concentric lamellæ and undulations of growth.

Interior characters unknown.

Dimensions: height of large specimen, 10^{cm}; width, about 7^{cm}.

In size this species approaches *Myalina ampla* M. and H. (Pal. Upper Missouri, p. 33, 1855), and fully equals *M. subquadrata* Shumard (Geol. Surv. Missouri, vol. 1, pt. 2, p. 207, 1855). It differs from the former species in the outline of the posterior side and in the narrowing of the lower portion of the shell, and also in the direction of the umbonal slope. The same differences exist between it and *M. subquadrata*.

Formation and locality.—Lower portion of Lower Carboniferous limestone on east slope of a small conical hill on the east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Genus MODIOLA Lamarck.

Modiola ? Nevadensis, n. sp.

Plate xix, fig. 8.

Shell thin, transversely elongate, narrow anteriorly, expanding gradually to the greatest height at a point back of the center; anterior end narrow and abruptly rounded; basal margin but little curved except posteriorly; posterior end somewhat narrowly rounded, and then sloping obliquely upward and forward to its union with the nearly straight cardinal line. Beaks small, depressed, anterior. General surface rather strongly convex anteriorly, and also backward along the broadly-rounded umbonal ridge.

Surface with fine concentric lines of growth.

With the single valves, and without specimens showing the hinge structure, the generic reference is more or less doubtful. The specimen illustrated has been accidentally compressed anteriorly, the basal margin having been pushed down and beneath its true position.

Formation and locality.—Lower portion of the Carboniferous Group, on the low hills south of Newark Mountain by the side of Pinto Creek, Eureka District, Nevada.

Genus MODIOMORPHA Hall.

Modiomorpha ambigua, n. sp.

Plate xx, fig. 1.

Shell rather below the medium size, transverse and subquadrate forward to the line of the beaks, in front of which it contracts rapidly to a rather narrow, rounded lobe; beaks small, and situated on the anterior third; hinge-line slightly arcuate; posterior end broadly rounded to the nearly transverse basal margin, which is a little curved towards the anterior lobe.

Surface marked by faint concentric striæ and a few stronger lines of growth.

There is some doubt attending the reference of this species to the genus Modiomorpha, as the hinge structure and muscular impressions are unknown; but in the absence of these characters the general form of the shell allies it to that genus.

Formation and locality.—Lower portion of the Carboniferous Group, on the east slope of a small conical hill on the east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Modiomorpha ? desiderata, n. sp.

Plate xx, fig. 3.

Shell of medium size; transverse, roughly suboval; beaks small, compressed, and situated within the anterior third, the portion of the shell in front of them contracting quite rapidly and becoming abruptly rounded in front; the posterior end is broken away, but, from the direction of the lines of growth, it was probably somewhat broadly rounded. The valves are moderately convex and the surface marked by a few lines of growth.

The nearest allied species appears to be *Modiomorpha Hyalea* Hall (Pal. N. Y., vol. v, pt. 1, Plates and Explanations, pl. xli, fig. 28, 1883), from the Waverly Group of Ohio.

As with the preceding species the generic reference is doubtful; and, although their generic relations are not clearly determined, it is thought desirable to give specific names to the well-marked species of the class to which they belong, as it is rarely well represented in the Carboniferous Group in the Rocky Mountains.

Formation and locality.—Lower portion of the Carboniferous Group, on the east slope of a small conical hill on the east side of Secret-cañon-road Cañon, Nevada.

Modiomorpha ? Pintöensis, n. sp.

Plate xx, fig. 2.

Shell of medium size, transversely subelliptical in outline; general surface moderately convex, with a rounded umbonal slope to the greatest posterior extension of the valve on the lower third of the posterior margin;

anterior end contracted and abruptly rounded; basal margin broadly arcuate and meeting the slightly oblique posterior line so as to form a rounded angle; cardinal margin nearly straight and forming an obtuse angle at its union with the posterior margin.

Surface ornamented by numerous concentric striæ.

Formation and locality.—Lower portion of the Carboniferous Group, northeast side of cañon north of Pinto Peak, Eureka District, Nevada.

Genus NUCULA Lamarck.

Nucula insularis, n. sp.

Plate xx, fig. 14.

Shell transverse, broadly and irregularly ovate, strongly convex, and with the beaks prominent and incurved; anterior end contracted and rounded somewhat abruptly, the posterior end more broadly rounded and the basal line still more; the point of union of the two latter is almost subangular, the posterior margin sloping upward somewhat obliquely.

Surface marked by fine concentric striæ and stronger varices of growth.

This species is allied to *N. bellastriata* Conr., and *N. varicosa* H. and W. (Pal. N. Y., vol. v, pt. 1, Plates and Explanations, pl. xlvi, 1883), of the Hamilton Group of New York.

Formation and locality.—Lower horizon of the Carboniferous Group, east slope of a small conical hill on east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Nucula levatiforme, n. sp.

Plate xxii, figs. 1, 1 *a*.

Shell very small, subtriangular in outline, moderately convex. Beaks elevated, incurved, situated on the anterior half of the shell.

Surface marked by fine, strong, concentric, depressed lines of growth.

Interior characters unknown.

Dimensions: height, 6^{mm}; width, 7^{mm}; convexity or depth of right valve, 2^{mm}.

This small species is more closely allied in external form to *Nucula ? levata* Hall (Pal. N. Y., vol. i, p. 150, pl. xxxiv, figs. 1 *a–i*, 1847), of the Trenton limestone of New York than to any Carboniferous species that I am acquainted with.

Formation and locality.—Lower portion of Lower Carboniferous limestone in cañon directly south of conical hill on east side of Secret-cañon-road Canon, Eureka District, Nevada.

Genus SOLENOMYA Lamarck.

Solenomya curta, n. sp.

Plate xxii, figs. 6, 11.

Outline transversely elliptical or oblong-oval, moderately convex. Hinge-line about one-half the length of the shell; beak depressed, situated at the anterior third of the shell.

Surface with narrow undulations of growth, crossed by nearly obsolete, radiating, flat plications, with finer striæ between.

Interior characters unknown.

Dimensions: height, 2.25^{cm}; width, 3.75^{cm}; convexity or depth of left valve, .5^{cm}. A smaller, more elongate right valve has a height of 1.5^{cm}, and a width of 3^{cm}. With but one specimen of the latter to study it is referred to this species somewhat provisionally, as there is no series of forms uniting it with the former.

I know of no species with which this can be directly compared, its shorter, higher form distinguishing it from described species.

Formation and locality.—Lower portion of Lower Carboniferous limestone on east slope of a small conical hill on the east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Genus MACRODON Lycett.

Macrodon Hamiltonæ Hall.

Plate xxiii, figs. 5, 5 *a–c*.

Macrodon Hamiltonæ Hall, 1870. Prelim. Notice Lam. Shells, 8vo., pamphlet, p. 13. *Idem.*, 1883. Pal. N. Y., vol. v, pt. 1; Plates and Explanations, pl. li, figs. 1–10.

In comparing a large series of specimens referred to this species from Nevada, with the beautiful illustrations of it given in the Paleontology of New York, and also with specimens from the Hamilton Group of New York, I do not find sufficient differences on which to base a specific separation of the Nevada and New York shells, although the former occur in strata of Lower Carboniferous age, and the latter in the lower half of the Devonian Group. The differences are in the outline of the cardinal margin as compared with the majority of the New York specimens, and the apparently thicker shell. The first is negatived by the occurrence of specimens of the same outline with the New York specimens, and the second is owing to the condition of preservation, the macerated, compressed shells of the Hamilton shales not preserving the original structure of the shell. The Nevada specimens show the large anterior muscular scar in the casts, but not the lateral teeth shown in many of the New York examples of the species.

Formation and locality.—Lower portion of Lower Carboniferous limestone in cañon directly south of a small conical hill on east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Macrodon truncatus, n. sp.

Plate viii, fig. 2.

Shell subrhomboidal, convex, with an undefined depression extending from the beak obliquely to near the center of the basal line; anterior side rounded, posterior side rounded below, nearly straight above. Hinge-line straight, nearly as long as the greatest width of the shell below. Umbo depressed, situated anterior to the middle of the valves; beak small, incurved.

Surface marked by concentric lines of growth and numerous fine radiating costæ closely arranged.

Interior characters unknown.

Dimensions: height, 6^{mm}; width, 10^{mm}; convexity of left valve, 3^{mm}. Right valve unknown.

This litttle shell is allied to *Macrodon parvus* W. and W. (Proc. Boston Soc. Nat. Hist., vol. viii, p. 299, 1862) of the Burlington Group of Iowa, and *M. Chemungensis* Hall (Pal. N. Y., vol. v, pt. 1; Plates and Explanations, pl. li, figs. 11–16, 1883), from the Chemung Group of New York. It is distinguished from each by its short form and strongly ornamented surface. The generic reference is made on the general character of the external shell, as the hinge-line and internal characters are unknown.

Formation and locality.—Lower portion of Lower Carboniferous limestone on east slope of a small conical hill, on the east side of Secret-cañon-road Cañon, Eureka, District, Nevada.

Genus GRAMMYSIA De Verneuil.

Grammysia Hannibalensis Shumard (Sp.).

Plate xx, fig. 4.

Allorisma hannibalensis Shumard, 1855. Geol. Surv. Missouri, vol. i, pt. 2, p. 206, pl. C, fig. 19.
Grammysia hannibalensis Hall, 1870. Prelim. Notice Lam. Shells, p.62.
Hannibalensis Meek, 1875. Pal. Ohio, vol. ii, p. 300, pl. xvi, figs. 5*a–c*.
Hannibalensis Hall, 1883. Pal. N. Y., vol. v, pt. 1, Plates and Explanations, pl. lxi, figs. 23–33.

After comparing the Eureka examples of this species with authentic specimens from the Waverly sandstone of Ohio, no reasonable doubt remained of their specific identity.

The species ranges from the Chemung Group of New York to the Waverly of Ohio, and at the base of the Carboniferous of Iowa and Missouri.

Formation and locality.—Carboniferous Group, lower portion, on east slope of a small conical hill on the east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Grammysia arcuata Conrad (Sp.)

Plate xx, fig. 5.

Posidonia ? arcuata Conrad, 1841. Ann. Rep. Geol. Surv. New York, p. 53.
Grammysia arcuata Hall, 1870. Prelim. Notice Lam. Shells, p. 56.
(*Leptodomus ?*) *arcuata* Hall, 1883. Pal. N. Y., vol. v, pt. 1; Plates and Explanations, pl. lxi, figs. 1–9.

Although this species is confined to the Hamilton Group of New York and Virginia, as far as heretofore known, we are unable to separate the Carboniferous shell from it on good specific grounds. Its occurrence at this locality and horizon is not surprising, as we have in the Devonian, and also at this same locality, examples of as great a range of supposed limited species, *e. g.*, *Pleurotomaria nodomarginata*, *Schizodus cuneatus*, etc.

Formation and locality.—Lower portion of the Carboniferous Group on the east slope of a small conical hill on the east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Genus EDMONDIA De Koninck.

Edmondia Medon, n. sp.

Plate xxiii, fig. 6.

Shell transversely subelliptical, moderately convex, equivalve. Hinge-line slightly arcuate; beaks depressed, situated on the anterior third of the shell.

Surface marked by concentric lines and undulations of growth.

Interior characters unknown.

Dimensions: height, 1 5^{cm}; width, 2.5^{cm}; convexity of single valve, 0.5^{cm}.

The specimen illustrated is the only well-preserved one we have of this species. In some respects it approaches *E. Burlingtonensis* W. and W. (See Pal. N. Y., vol. v, pt. 1; Plates and Explanations, pl. lxiv, figs. 19–29, 1883), of the Burlington limestone of Iowa, and the Chemung Group of New York, differing in its more elliptical form and depressed beak.

Formation and locality.—Lower portion of Lower Carboniferous limestone on east slope of a small conical hill on the east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Edmondia ? circularis, n. sp.

Plate xxii, fig. 9.

Shell large; general outline broadly ovate or subcircular, moderately convex, most prominent at the umbonal region. Hinge-line unknown, but probably arcuate; beaks depressed, curved over towards the cardinal line.

Surface marked by concentric lines of growth as far as known. Interior characters unknown.

Dimensions: height, 5^{cm}; width, 6^{cm}; convexity of left valve, 1.5^{cm}.

I know of no species with which to compare this. The generic reference is made on the general form and appearance, as nothing is known of the interior characters.

Formation and locality.—Lower portion of Lower Carboniferous limestone in cañon directly south of a small conical hill on east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Genus PLEUROPHORUS King.

Pleurophorus Meeki, n. sp.

Plate viii, fig. 3.

Shell small, longitudinally oblong, widening posteriorly; moderately convex on the line of the umbonal slopes from the beak to the postero-basal margin, forming a nearly rounded section from the basal to the cardinal margin. Hinge-line long and nearly straight, with a narrow but well-defined lunette. Beaks located very near the anterior extremity.

External surface of the shell unknown. The cast shows 5 or 6 radiating costæ and traces of concentric lines of growth.

The anterior adductor-muscular impression is bounded by a rather strong ridge on the posterior side; pallial line simple and extending to the slightly-marked posterior-adductor muscular scar; teeth unknown.

This species is more nearly related to the English Permian species *Pleurophorus costatus* King (Mon. Perm. Foss., plate xv) than to any American form that I am acquainted with. The narrow form and posterior expansion serve to distinguish it from described species of the genus.

Formation and locality.—Lower portion of Lower Carboniferous limestone in cañon directly south of a small conical hill on east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Genus SANGUINOLITES McCoy.

In the absence of the structure of the hinge-line, the muscular scars, and pallial impression in the following species, there is some uncertainty in referring them to this genus, as in their general external appearance they resemble more or less forms referred to the Modiomorphidæ.

Sanguinolites Æolus H. & W.

Plate xx, figs. 6, 7, 9.

Sanguinolites æolus Hall, 1870. Prelim. Notice Lam. Shells, p. 46.
? æolus Meek, 1875. Pal. Ohio, vol. ii, p. 307, pl. xvi, figs. 1 *a–c*.
Æolus Hall, 1883. Pal. N. Y., vol. v, pt. 1, Plates and Explanations, pl. lxvi, figs. 31–35, 43.

The specimen illustrated by fig. 6 is a typical form of this species, corresponding to those from the Waverly sandstone of Ohio, and we cannot distinguish the shorter, broader shells, as shown by figs. 7 and 9, as a distinct species, as there is a complete gradation of form between them, and to even a still broader variety that is designated in the systematic list as *S. Æolus*, var. A small shell of this species from the same locality resembles very closely some examples of *Sanguinolites rigidus*, an illustration of which is given from the Devonian limestone on plate xvi, fig. 6.

Formation and locality.—Lower portion of the Carboniferous Group on the east slope of a small conical hill on the east side of Secret-cañon-road Cañon, Eureka District, Nevada

Sanguinolites retusus, n. sp.

Plate xx, fig. 10.

Shell broad, irregularly ovate; moderately convex; beaks anterior, small and compressed; umbonal slope distinctly angular and extending from the beaks to the postero-basal angle, the somewhat rapidly sloping postero-cardinal slope being marked midway by a slight longitudinal ridge. Cardinal line short and a little arcuate; basal line broadly rounded, uniting posteriorly with the slightly rounded, oblique posterior line to form a rounded, obtuse angle, and rounding up more rapidly anteriorly in the more abruptly curved end.

Surface marked by concentric lines of growth, and in well-preserved examples fine concentric striæ are visible.

This species is readily distinguished by its rotund outline from the associated species.

Formation and localities.—Associated with the preceding, and also on the northeast slope of the cañon north of Pinto Peak, Eureka District, Nevada.

Sanguinolites simplex, n. sp.

Plate xx, fig. 11.

Shell rather above the average size, transverse, irregularly broad-ovate, beaks small, compressed, and situated on the anterior third of the shell; umbonal slope angular from the beak to the posterior basal angle; general surface of the valves moderately and regularly convex, except the postero-cardinal slope, which falls away more rapidly from the umbonal ridge; it is marked by a faint, central longitudinal ridge. The general outline is not very much unlike that of the preceding species, except in the more pointed extremities and the near approach of the umbonal ridge to the postero-cardinal margin.

Surface marked by fine concentric striæ, and a few stronger lines of growth.

Formation and locality.—Lower horizon of the Carboniferous Group, eastern slope of a small conical hill on the east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Sanguinolites Salteri, n. sp.

Plate xx, fig. 12.

Shell rather small, transversely elongate, nearly three times as long as high; cardinal and basal margins subparallel or slightly diverging on the posterior half of the shell; beak small, depressed, and situated near the anterior end, which is narrow, short, and abruptly rounded; basal margin nearly transverse along the center, curving up rather abruptly anteriorly, and more gently at the posterior end; posterior line abruptly rounded at the point of greatest extension on a line with the center of the shell, above which it curves forward to the straight cardinal line. Valves marked by several distinct, but not prominent, ridges on the postero-cardinal slope.

Surface ornamented by fine concentric striæ, and a few obscure lines of growth.

Formation and locality.—Lower horizon of the Carboniferous Group, eastern slope of a small conical hill on east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Sanguinolites ? Nænia, n. sp.

Plate xix, fig. 9.

Shell small, transversely elongate, the height being one-half the length; beaks small, depressed, and situated on the anterior third; anterior end narrow, somewhat elongate and so abruptly rounded as to be almost angular; basal line slightly sinuate midway and curving up at each end; posterior end broadly rounded; cardinal line nearly straight The general surface of the valves is moderately convex, with a slight umbonal ridge extending from the beak to the postero-basal curve, and also a rather broad, shallow mesial depression.

Surface marked by several well-defined, concentric undulations of growth.

Formation and locality.—Lower horizon of the Carboniferous Group, eastern slope of a small conical hill on east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Sanguinolites striatus, n. sp.

Plate xxiii, fig. 7.

Shell transversely elongate-oval, compressed convex, posterior umbonal slope angular. Cardinal line long, straight. Beak appressed, situated at about the anterior third.

Surface marked by strong concentric striæ that curve up rather abruptly in crossing the angular umbonal ridge.

Interior characters unknown.

There are three specimens preserving the anterior portions of the shell, but none showing the entire outline. The specimen illustrated has the form we have considered as belonging to the genus Sanguinolites.

The strongly striated surface distinguishes it from described species known to me.

Formation and locality.—Lower portion of Lower Carboniferous limestone, on east slope of a small conical hill on the east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Genus MICRODON Conrad.

(CYPRICARDELLA Hall.)

Microdon (Cypricardella) connatus, n. sp.

Plate xxiv, figs. 5, 5*a*.

Shell transversely subovate or subrhomboidal, moderately convex. Hinge-line about two-thirds the length of the shell. Beaks small, depressed, and situated on the anterior third of the shell.

Surface marked by rather distinctly defined concentric striæ.

The interior cast shows an anterior adductor muscular scar of medium size, also an undefined depression extending from the beak obliquely backward on the line of the umbonal ridge.

Dimensions: height, 1.75^{cm}; length, 3^{cm}; convexity of the two valves united, 1^{cm}.

In form this species approaches very closely to *Microdon* (*C.*) *gregarius* Hall, and in surface characters *M.* (*C.*) *bellistriatus* Conrad (Pal. N. Y., vol. v, pt. 1; Plates and Explanations, pls lxxiii, lxxiv, 1883). While differing from both, it combines, in a measure, the specific characters of each.

The reference of this and also the Devonian *M. macrostriatus* (*ante*, p. 180) to the genus Microdon is tentative. Professor Hall proposed the name Eodon as a substitute for Microdon, as the latter had already been used for a genus of fishes and a genus of insects (Miller's Cat. Pal. Foss., Addenda, p. 244, 1877). In the Paleontology of New York (vol. v, part 1; Plates and Explanations, p. 18, 1883), a second generic name is placed between Microdon and Eodon, viz, Microdonella. Professor Hall previously described the genus Cypricardella for similar forms from the Warsaw limestone (see remarks by Mr Whitfield, Bull. Amer Mus. Nat Hist, vol. i, No. 3, p. 63), and if Microdon is dropped Cypricardella will have to be substituted.

Formation and localities.—Lower portion of Lower Carboniferous limestone in the cañon north of Pinto Peak, and also on the east slope of a small conical hill on the east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Genus CARDIOLA Broderip.

Cardiola ? filicostata, n. sp.

Plate xxii, figs. 4, 4*a*.

Shell obliquely oval, moderately convex. Beak somewhat elevated, small and incurved.

Surface marked by fine, radiating, slightly irregular, elevated striæ, and a few concentric lines of growth.

Interior characters unknown.

Dimensions: height, 1.5^{cm}; width, 2^{cm}; convexity or depth of left valve, 0.5^{cm}.

The generic reference is doubtful, owing to the absence of the interior characters, and also the strong surface costæ, so characteristic of Cardiola. The only related species referred to the genus is *Cardiola transversa* Hall (Pal. N. Y., vol. v, pt. 1; Plates and Explanations, pl. lxx, figs. 12–15).

Formation and locality.—Lower portion of Lower Carboniferous limestone on east slope of a small conical hill on the east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Genus SCHIZODUS King.

Schizodus cuneatus Meek.

Plate xx, fig. 8.

Schizodus cuneatus Meek, 1875. Pal. Ohio, vol. ii, p. 336, pl. xx, fig. 7.

There does not appear to be any points of specific difference between the Ohio shell illustrated by Mr. Meek and the examples of this species from Nevada. The latter are proportionally a little narrower, but this may be owing to the state of preservation, as the Ohio shell is compressed in a shale, and the Nevada specimens retain their natural convexity and outline.

Formation and locality.—Lower portion of the Carboniferous group, on the eastern slope of a small conical hill on the east side of Secret cañon-road Cañon, Eureka District, Nevada.

Schizodus deparcus n. sp.

Plate xxii, fig. 5.

Shell large, transversely suborbicular, moderately convex; umbonal ridge rounded and passing into the postero-dorsal slope without any perceptible angle being developed. Beak small, elevated, incurved, and situated a little anterior to the center of the shell.

Surface smooth as far as known, except a few radiating lines on the postero-dorsal slope.

Anterior muscular scar not large, ovate in outline; posterior scar elongate, and crossed longitudinally by two slightly depressed lines, probably from the radiating lines of the postero-dorsal slope of the shell. Pallial line simple.

Dimensions: height, 4.25^{m}; width, 5^{cm}; convexity or depth of right valve, 1.5^{cm}. In size this species approaches *Schizodus cuneatus* (*ante*). It differs in being less erect, less angular in outline, and in having a smooth surface.

Formation and locality.—Lower portion of Lower Carboniferous limestone on east slope of a small conical hill on the east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Schizodus curtiforme, n. sp.

Plate xxii, figs. 3, 3*a*.

Shell small, subrhomboidal, moderately convex; posterior dorsal region back of the umbonal ridge compressed and cuneate; umbonal slope distinctly angular from the beak to the postero-basal margin; anterior slope rather abrupt to the anterior margin. Beak elevated, incurved, and situated a little anterior to the center.

Surface of the cast with a few indications of concentric lines of growth.

Interior characters unknown.

Dimensions: height, 1.5^{cm}; width, 1.75^{cm}; convexity or depth of right valve, .5^{cm}.

This little species is related to *Schizodus curtus* M. and W. (Geol. Surv. Ill., vol. v, p. 582), and *S. Rossicus* De Vern. (Russ. and Ural Mts., p. 309), but can scarcely be referred to either specifically.

Formation and locality.—Lower portion of Lower Carboniferous limestone in cañon directly south of a small conical hill on east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Schizodus Pintöensis, n. sp.

Plate xxii, figs. 2, 2*a*.

Shell about the average size of species of the genus; outline obliquely subrhomboidal; base strongly arcuate; umbonal slope distinctly angular, with the posterior side flattened; general surface moderately convex, curving evenly over the central portions anterior to the umbonal angle and then more abruptly down to the anterior margin. Beaks elevated, incurved, and placed on the anterior third of the shell.

Surface of cast showing a few lines of growth.

Dimensions: height, 2^{cm}; width, 2.25^{cm}; convexity or depth of left valve, 0.5^{cm}.

Some of the examples are more oblique, and have the appearance of being more erect, owing to the greater curvature of the basal margin. This is shown in the illustration of the right valve.

In comparing with *Schizodus cuneus* Hall, from the Waverly Group (Pal. N. Y., vol. v, pt. 1; Plates and Explanations, pl. lxxv, figs. 27–30), a strong resemblance is apparent, the Nevada shell differing only in its more robust form and in the strongly arcuate basal and anterior margins.

Formation and locality.—Lower portion of Lower Carboniferous limestone, in the cañon northeast of Pinto Peak, Eureka District, Nevada.

GASTEROPODA.

Genus PLATYCERAS Conrad.

Platyceras occidens, n. sp.

Plate xxiv, figs. 9, 9*a*.

Shell obliquely subconical, apex minute and strongly incurved, the nucleus making about one volution and then rapidly expanding; the dorsum is somewhat abruptly rounded but not carinate; the right side is gently and evenly convex to the rounded angle formed by the union with the front; the left side is more abruptly convex, and curves forward imperceptibly into the anterior surface. Aperture subtriangular in outline with the peristome sinuous.

Surface marked by fine, well-defined, undulating striæ of growth.

This is a small and very pretty species. It may be compared with some forms of *Platyceras carinatum* Hall (Pal. N. Y., vol. v, pt. 2, p. 5, pl. ii, figs. 12–29) of the Devonian.

Formation and locality.—Lower portion of Lower Carboniferous limestone, in cañon directly south of a small conical hill on east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Platyceras Piso, n. sp.

Plate xxiv, figs. 7, 7 *a*, *b*.

Shell obliquely and strongly arcuate; apex minute, incurved, making about one volution; body-whorl expanding rather rapidly at first and then very gradually to the aperture; dorsum rounded; sides and dorsum with seven or eight slight longitudinal plications; aperture broadly subovate with the peristome sinuous.

Surface covered with fine, undulating striæ of growth that are crowded together irregularly, forming slight concentric undulations.

The arcuate form of the body-whorl distinguishes this species from *Platyceras acutirostris* Hall (Geol. Surv. Iowa, vol. i, pt. 2, p. 665, pl. xxiii, fig. 14) of the Lower Carboniferous of Indiana, etc., the most nearly allied species.

Formation and locality.—Lower portion of Lower Carboniferous limestone, in cañon directly north of a small conical hill on east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Genus PLATYOSTOMA Conrad.

Platyostoma inornatum n. sp.

Plate xxiv, figs. 3, 3 *a*.

Shell subglobose; spire elevated above the body whorl; volutions three or four, and perhaps a fifth very minute one, that is not preserved in the specimen illustrated. The outer volution expanding towards the aperture, but scarcely ventricose; aperture vertically ovate or subrhomboidal; the columellar lip appears to have been reflexed.

The few fragments of the outer shell that are preserved show it to have been nearly if not quite smooth.

This species resembles some forms of *Platyostoma lineatum* (*ante*, p. 185) of the Devonian of New York.

Formation and locality.—Lower portion of Lower Carboniferous limestone, in cañon directly south of a small conical hill on the east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Genus EUOMPHALUS Sowerby.

Euomphalus (Straparollus) subrugosus M. & W.

Plate xviii, fig. 19.

Euomphalus rugosus Hall, 1858. Geol. Surv. Iowa, vol. i, pt. 2, p. 722, pl. xxix, figs. 14 *a–c*. (Not *Euomphalus rugosus* Sowerby, 1849.)

Serpula (*Spirorbis*) *planorbites* Geinitz, 1866. Carb. und Dyas in Nebraska, p. 2, pl. i, fig. 6, (not of Munster).

Straparollus (*Euomphalus*) *rugosus* Meek, 1872. U. S. Geol. Surv. Nebraska, p. 230 pl. vi, figs. 5 *a*, *b*; pl. xi, figs. 4 *a*, *b*.

Straparollus (*Euomphalus*) *subrugosus* Meek & Worthen, 1873. Geol. Surv. Illinois, vol. v, p. 607, pl. xxix, figs. 11 *a–c*.

The example of this species in the collection has the essential features observed in the specimens from the Coal Measures of Illinois, Nebraska, etc., and no specific differences are recognized between the form from Nevada and those of the Mississippi Valley region.

Formation and locality.—Lower portion of the Carboniferous Group, on the east slope of a small conical hill on the east side of the Secret-cañon-road Cañon, Eureka District, Nevada.

Genus BELLEROPHON Montfort.

Bellerophon majusculus, n. sp.

Plate xxiii, figs. 1, 1 *a*; plate xxiv, fig. 6.

Shell thick and strong, very large, subglobose; body volution subglobose, expanded a little at the aperture, marked by a well-defined median carina; outer lip with a strong sinus in front, rounded at the sides, somewhat reflexed and greatly thickened over the umbilical areas, entirely concealing the openings. Inner margin of the columellar lip very much thickened, boss-like, extending out into the aperture and giving the latter a broadly subreniform outline; the outer lip probably extended over a portion of the columellar lip, but the specimens at hand do not show this clearly.

Surface characters mostly obliterated, a few of the stronger lines or wrinkles of growth alone remaining; these curve gently forward between the dorsal carina and the umbilicus.

Dimensions: greatest length, 12^{cm}; breadth at umbilicus, 7.5^{cm}; at aperture, 11^{cm}. Aperture, 3.5^{cm} by 7.5^{cm} in a specimen 10^{cm} long, by 6.5^{cm} wide at the umbilicus.

This large Bellerophon is most nearly related to *Bellerophon costatus* Sowerby, as figured by De Koninck (Anm. Foss., plate xxvi, fig. 2 *a–e*). It differs in the direction of the lines of growth, form of aperture, and the thickening of the columellar lip. *Bellerephon crassus* M. and W. (Geol. Surv. Ill., vol. ii, p. 385, pl. xxxi, figs. 16 *a*, *b*), from the Lower Coal Measures of

Illinois, is the largest American species of the genus. It varies materially from *B. majusculus* in the character of the columellar lip.

Formation and locality.—Lower portion of Lower Carboniferous limestone in a cañon a little north of Pinto Peak, Eureka District, Nevada.

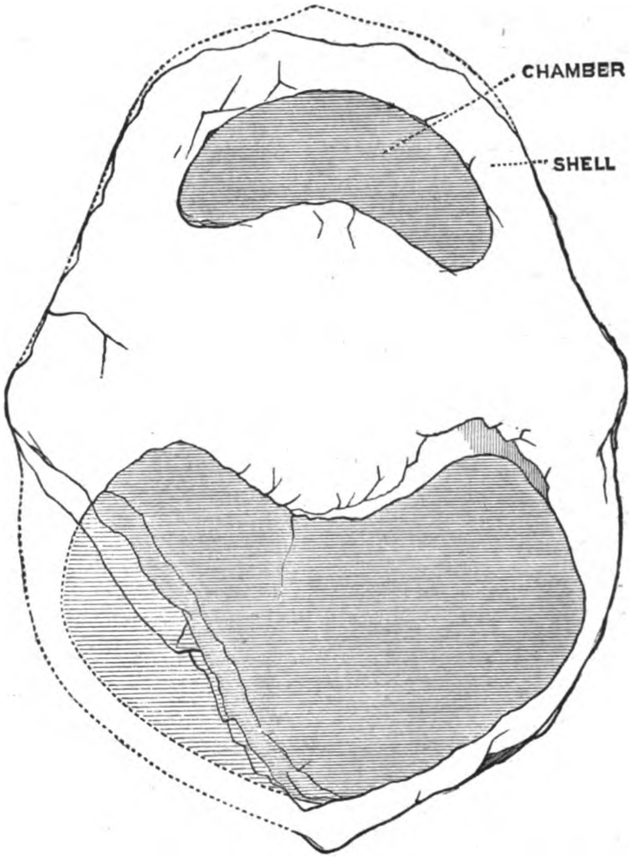

FIG. 3.—Section of the large specimen figured on plate xxiii, fig. 6. The chamber of the interior whorls is filled in with calcite, which leaves only the outer whorl clearly outlined, including a section of its chamber.

Bellerophon textilis Hall ?

Plate xviii, fig. 18.

Bellerophon cancellatus Hall, 1856. Trans. Albany Inst., vol. iv, p. 31 (not *B. cancellatus* Hall, 1847, Pal. N. Y., vol. i, p. 307).

Bellerophon textilis Hall, 1877. Proposed instead of *B. cancellatus* Hall (preoccupied). Miller's Cat. Amer. Pal. Foss., p. 243.

Our specimens are all more or less crushed and distorted, but comparisons with examples of *B. textilis* from the Warsaw limestone of Indiana exhibit strong specific resemblances which, in the absence of more perfect specimens to show possible differences, place the Eureka shell in the same species.

Two other species occur in the same beds; one is like *B. sublævis* Hall, 1856 (Trans. Albany Inst., vol. iv, p. 32), of the Warsaw limestone, and the other is of the character of *B. ellipticus* McChesney (see Trans. Chicago Acad. Sci., vol. i, p. 44), from the Coal Measures of Illinois, but there is not sufficient material to decide conclusively upon the specific relations.

Formation and locality.—Lower portion of the Carboniferous Group, east side of Secret-cañon-road Cañon on east slope of a small conical hill, Eureka District, Nevada.

Genus LOXONEMA Phillips.

Loxonema bella, n. sp.

Plate xxiv, figs. 1, 1*a*.

Shell small elongate-conical; spire elevated, tapering to an acute point. Volutions fourteen to fifteen, very slightly convex, increasing gradually in size to the last one, which is a little enlarged and rather abruptly rounded below the middle.

Suture close but not deep. Aperture subovate or subrhombic, longer than wide.

Surface smooth to the unaided eye, but under a strong magnifying glass shows fine concentric striæ of growth that curve slightly forward; at the suture these are a little stronger.

Dimensions: length, 18^{mm}; breadth of body volution, 7^{mm}; divergence of apical angle, 24°.

In many particulars this species is closely allied to *Loxonema cerithiformis* M. and W. (Geol. Surv. Ill., vol. ii, p 379, pl. xxxi, figs. 13 *a–c*), and *Chemnitzia subconstricta* De Koninck (Anm. Foss., plate lviii, figs. 17 *a*, *b*). It differs from each in having less convex volutions, and the surface striæ at the suture are not gathered in short crenulations. The cast has the form of the volution shown in both Meek's and De Koninck's figures.

The slope of the spire of *L. bella* is more like that of the minute *Chemnitzia lævigata* Deshayes (Leth. Rossica, pl. xlii, figs. 6 *a*, *b*) of the Tertiary.

Formation and locality.—Lower portion of Lower Carboniferous limestone, in cañon directly south of a small conical hill on the east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Genus PLEUROTOMARIA Defrance.

Pleurotomaria nodomarginata McChesney.

Plate xviii, fig. 15.

Pleurotomaria nodomarginata McChesney, 1860. Desc. New Species of Fossils, p. 70. Trans. Chicago Acad. Sci., 1869, vol. i, p. 47, pl. vii, figs. 1 *a–c*.

Notwithstanding that Mr. McChesney gives the Hamilton Group as the horizon from which *P. nodomarginata* was obtained, the identification is here made with a shell coming from the Lower Carboniferous of the Eureka District. This conclusion is arrived at only after the most careful comparisons, which appear to leave very little if any doubt of the specific identity of the Nevada and Missouri shells.

Formation and locality.—Lower portion of the Carboniferous Group, east side of Secret-cañon-road Cañon on east slope of a small conical hill, Eureka District, Nevada.

Pleurotomaria Nevadensis, n. sp.

Plate xxiv, figs. 2, 2*a*.

Shell turbinate; spire elevated, height and width subequal; volutions five or six, expanding quite regularly to within a half of a volution of the aperture, when it becomes more ventricose; body volution angulated, depressed convex above and rounded below; umbilicus small. Aperture broadly oval to subcircular.

Surface marked by strong, regular, revolving lines above and below the peripheral band, crossed and cancellated by finer concentric striæ that cut into the revolving lines and give them a fine nodose appearance. The concentric striæ are directed a little backward from the suture to the band;

arching backward in crossing the rather narrow surface defined by the simple carina above and below, they trend forward at about the same angle to the suture as they do above from the band to the suture.

Formation and locality.—Lower portion of Lower Carboniferous limestone, in cañon directly south of a small conical hill on east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Genus MACROCHEILUS Phillips.

Macrocheilus, sp.?

Plate xxiv, fig. 8.

The general form of this species is not unlike that of *Macrocheilus Altonensis* Worthen (Geol. Surv. Ill., p. 593, pl. xxviii, fig. 8) of the Coal Measures of Illinois. Owing to the imperfect preservation of the aperture, it is impossible to make a satisfactory specific reference.

Formation and locality.—Lower portion of Lower Carboniferous limestone, in cañon directly south of a small conical hill on east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Genus METOPTOMA Phillips.

Metoptoma perocoidens, n. sp.

Plate xviii, fig. 16.

Shell depressed, patelliform, rounded quadrangular or suboval in outline, the greater and less diameters being 26^{mm} and 20^{mm}; apex subcentral, with the sides sloping away uniformly to the lateral margins and not quite as rapidly to the anterior and posterior margins.

Surface marked by fine concentric lines or striæ of growth and narrow radiating lines of a darker color. The original color of the shell is partially preserved, the dark radiating lines of color on the purplish-gray surface giving it the appearance of a recent Acmæa (*A. testudinalis*).

Formation and locality.—Lower portion of the Carboniferous Group, Richmond Mountain, Eureka District, Nevada.

Genus AMPULLARIA Lamarck.

Ampullaria ? Powelli Walcott.

Ampullaria ? Powelli Walcott, 1883. Science, vol. ii, p. 808, figs. 3, 3*a*.

Shell subglobose; umbilicus small; spire depressed; volutions three or four, increasing uniformly in size until the last one, which is larger in proportion and slightly expanded at the aperture; suture distinct; aperture oblong, broad ovate, and a little straightened on the inner side, entire; peristome continuous, slightly reflexed.

Surface marked by fine lines of growth. Operculum concentric, rather thick, and of a calcareous or shelly structure; nucleus subcentral.

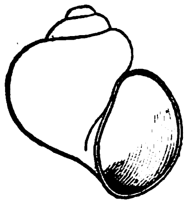

FIG. 4.—Outline figure of a typical shell, × 3.

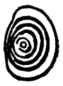

FIG. 5.—*Operculum*, × 3.

In referring this species to the genus Ampullaria we bear in mind that it is not probable that a genus of this character has continued from the Middle Paleozoic to the present time; on the other hand, when we consider that the shell is Ampullaria-like in character and associated with an operculum that is almost characteristic of the genus, that the genus Pupa is known from the Middle Carboniferous, and that a shell not to be distinguished from the recent Physa is associated with *Ampullaria ? Powelli*, a pulmoniferous shell *Zaptychius Carbonaria* and a twig of a coniferous tree, all of which are evidences of a near land area, it would appear that a reference to Ampullaria, as the genus representing the group to which the species belongs is warranted by the facts, although it may be ultimately referred to a new genus or subgenus.

Formation and localities.—Lower portion of the Carboniferous Group, on the western slopes of New York and Richmond Mountains, Eureka District, Nevada.

PULMONIFERA.

For an excellent summary of what was known of the Paleozoic representatives of this subclass up to the month of November, 1880, we are indebted to Dr. J. W. Dawson, who states that the three known localities of their occurrence are on the American continent, and that six species were described from them, namely: *Pupa vetusta, P. Bigsbyi* Dawson, *Zonites* (*Conulus*) *priscus* Carpenter, from the Coal Measures of the South Joggins, Nova Scotia; *Pupa Vermillionensis, Dawsonella Meeki* Bradley, from the Upper Coal Measures of Vermillion River, Illinois, and *Strophites grandæva* Dawson, from the Devonian plant beds of St. John, New Brunswick (Amer. Journ. Sci., 3d ser., vol. xx, p. 403, 1880). Subsequently Prof. R. P. Whitfield gave the results of his study of *Dawsonella Meeki*, showing that it was probably an operculate shell, and he also described *Anthraco-pupa Ohioensis* from the higher beds of the Coal Measures at Marietta, Ohio (*Ibid.*, xxi, p. 125, 1881). All of the species are true land shells, the aquatic division of the Pulmonifera being unrepresented up to the time of the discovery in Nevada of the species to be described. The geologic horizon at which the latter occur is intermediate in position to the Devonian plant beds of New Brunswick and the localities in the Coal Measures of Nova Scotia, Illinois, and Ohio.

A brief notice of these shells was published in Science, vol. ii, p. 808, 1883.

Genus PHYSA Draparnaud.

Physa prisca Walcott.

Physa prisca Walcott, 1883. Science, vol. ii, p. 808, fig. 2.

Shell small, oblong, sinistrally spiral, and with about four volutions, the last one expanded, ventricose, with the short, small spire above less than one-fourth its length; aperture more than three-fourths of the length of the body volution, broadly rounded anteriorly, becoming more pointed at the opposite end; outer lip thin, inner lip slightly reflected on the last whorl.

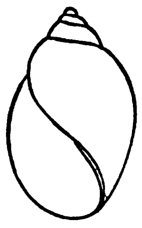

FIG. 6.—Outline of shell, ×3.

Surface smooth or marked by fine lines of growth.

The shell is apparently that of a true Physa, although thicker than in most species of the genus. It may belong to a subgeneric group, but of this we have little evidence in the specimens before us.

The largest specimen has a length of 9^{mm}, and the smallest of 4^{mm}.

Formation and localities.—Lower portion of the Carboniferous Group, in a chocolate-colored limestone, on the western slope of New York and Richmond Mountains, Eureka District, Nevada.

Genus ZAPTYCHIUS, n. g.

Shell minute, elongate; aperture large, oblong, nearly vertical; outer lip thin, columellar lip reflected, plicated.

Surface of shell marked by slightly oblique longitudinal striæ.

Type: *Zaptychius carbonaria.*

Zaptychius appears to have its nearest living ally in Auricula, although differing in the form of the body volution and spire from the typical forms of that genus; the presence of the Auricula-like aperture and elongate shell, vertically striated, afford the basis for a new generic description.

Zaptychius carbonaria Walcott.

Zaptychius carbonaria Walcott, 1883. Science, vol. ii, p. 808, fig. 1.

Shell small, slender, the body volution having a length of about 6.5^{mm}, and a greater diameter of 2.5^{mm}; aperture rather large, elongate, narrow posteriorly and broadly rounded in front; columellar lip thickened anteriorly, the thickened portion curving inward opposite the umbilical chink to form a rounded plication or ridge on the lip, which is reflected back on the volution and marked by a second tooth-like plication projecting a short distance out into the aperture a little posterior to the first. The number of volutions is unknown.

Surface of the shell marked by even, equidistant, nearly vertical striæ that distinctly define the interspaces between them.

The form of the spire above the portion of the volution preceding the body volution is unknown, although from the character of that preserved and the presence of a trace of a volution 3.5^{mm} above the body volution, it was probably more or less slender and elongate.

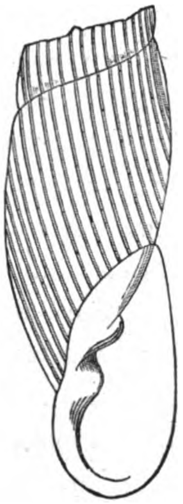
FIG. 7.—Outline of type specimen, ×8.

Formation and locality.—Lower portion of the Carboniferous formation, in a chocolate-colored limestone, associated with *Physa prisca* and *Ampullaria ? Powelli*, Eureka District, Nevada.

PTEROPODA.

Genus CONULARIA Miller.

Conularia Missouriensis Swallow ?

Plate xxiii, fig. 4.

Conularia Missouriensis Swallow, 1860. Trans. St. Louis Acad. Sci., vol. i, p. 657.

The description given by the author of this species agrees so closely with the specimen before me that in the absence of the type, or a good illustration, it is identified with it. Both the Missouri and Nevada specimens occur in the lower portion of the Lower Carboniferous limestone.

Formation and locality.—Lower portion of the Lower Carboniferous limestone, Mokomoke Ridge, White Pine Mining District, Nevada.

Genus HYOLITHES Eichwald.

Hyolithes carbonaria, n. sp.

Plate xxiii, fig. 3.

Form an elongate triangular pyramid, gradually and regularly tapering to an acute extremity; angle of divergence of the sides, 18°. Transverse section subovate, slightly convex on the ventral side, the lateral margins rounded, and the dorsal side a little more convex than the opposite side. Aperture oblique, the ventral side being a little prolonged. Shell rather thick. Operculum unknown.

Surface with fine, concentric, radiating or longitudinal striæ.

Dimensions: length, 11^{mm}; diameter at aperture, 3.5^{mm} by 2^{mm}.

In the cast a longitudinal groove is seen on the ventral face near each lateral margin; it extends only a little way back from the aperture.

This pretty little shell has the form of *Hyolithes aclis* Hall (Pal. N. Y., vol. v, pt. 2, p. 197), of the Devonian of New York, but it is more slender and probably a much smaller species. Also compare with *Hyolithes novellus* Barrande (Syst. Sil. Bohême, vol. iii, pl. xv, figs. 23, 24.)

Formation and locality.—Lower portion of Lower Carboniferous limestone, in cañon directly south of a small conical hill on the east side of Secret-cañon-road Cañon, Eureka District, Nevada.

CEPHALOPODA.

Genus ORTHOCERAS Breynius.

Orthoceras Randolphensis Worthen?

Plate xviii, fig. 17.

Orthoceras annulato-costatum Meek & Worthen, 1861. Proc. Acad. Nat. Sci. Philad., vol. xiii, p. 147. *Ibid.*, 1866. Geol. Illinois, vol. ii, p. 304, pl. xxiv, figs. 3 *a–b*. (Not *Orthoceras annulato-costatum* Boll, 1857.)

Orthoceras Randolphensis Worthen, 1882. Bull. Ill. State Mus. Nat. Hist., No. 1, p. 38. By error in the Bulletin the original reference of this species is given as *Orthoceras annulo-costatum* M. & W., 1862, Geol. Surv. Ill., vol. vi, instead of as above.

With the means of comparison at hand the fragmentary remains of this form from Nevada appear to be identical with those from the Chester limestone of the Lower Carboniferous formation of the State of Illinois. The most marked difference between them is the greater obliquity of the annulations in the Nevada specimens, but this may be owing in a measure to the crushing of the tube, which is compressed very much in all the examples collected.

Formation and locality.—Lower portion of the Carboniferous limestone, on the eastern slope of a small conical hill on the east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Orthoceras Eurekensis, n. sp.

Plate xxiii, figs. 2, 2 *a*.

Shell slightly curved. Transverse section broadly oval; the dorso-ventral diameter the shorter, having a ratio of 7 to 8 with the lateral diameter. Tube gradually and regularly enlarging. Chamber of habitation unknown. Air-chambers have a depth of 4^{mm} where the dorso-ventral diameter of the tube is 14^{mm}. Septa thin, smooth, moderately concave. The suture has a broad retral curve over the dorso-ventral sides of the tube, extending forward over both the lateral faces.

Siphuncle small, slightly eccentric, and nearer the dorsal face of the septum; a narrow, flat areola surrounds it in the one section exposed to view. The character of the siphuncle in its passage between the septa has not been observed.

The test is rather strong, and is vertically striated on the interior as shown in the cast, the striæ being exceedingly fine. The exterior surface has been so injured by the mineralization of the test, that its characters are not determinable.

A slight carina is preserved on the cast of the dorsal surface. It does not appear to have any connection with the siphuncle or areola surrounding it.

Orthoceras clinocameratum Winchell (Amer. Jour. Sci., vol. xxxiii, p. 356, 1862) is the only American species that appears to correspond to this. With the description to decide from, it does not appear that the Michigan and Nevada shells belong to one species.

Formation and locality.—Lower portion of Lower Carboniferous limestone in cañon directly south of a small conical hill on east side of Secret-cañon-road Cañon, Eureka District, Nevada.

Orthoceras, sp. ?

A small species, with fine vertical annulations, is associated with *O. Eurekensis.* It appears to be slightly curved, and to have its cone enlarging gradually and uniformly.

PŒCILOPODA.

Genus GRIFFITHIDES Portlock.

Griffithides Portlocki M. & W.

Plate xxiv, figs. 4, 4 *a*, *b*.

Phillipsia (*Griffithides*) *Portlocki* Meek & Worthen, 1865. Proc. Acad. Nat. Sci. Philad., vol. xvii, p. 268. *Ibid.*, 1873. Geol. Surv. Illinois, vol. v, p. 525, pl. xix, fig. 6.

The detailed and elaborate description given of this species by its authors provides the means for a close comparison between it and the Nevada specimens.

The most striking difference is the greater strength of the postero-lateral spine of the free cheek in the Nevada form. This, however, is scarcely a specific variation, and the other variations are not of specific value.

Judging from the external features of the head, this species may be referred to the genus Griffithides. In the cast traces of two anterior pairs of glabellar furrows appear, but these are not seen on the outer surface of the shell. Again, the form of the glabella is that of the typical forms of Griffithides.

Of the nineteen species referred to the genus Phillipsia, from American Paleozoic strata, I do not know of one that would not admit of question. Eight are founded on specimens of the pygidium alone, and the generic reference is consequently questionable. One species, *Phillipsia Lodiensis* Meek (Pal. Ohio, vol. ii, p. 323, plate xviii, fig. 3), is, as suggested by Mr. Meek, referable to the genus Proetus or a subgenus of Proetus, and in this same list may be included the two Devonian species (*ante* p. 211 and Pal. N. Y., Illustrations of Devonian Fossils, plate xxi, fig. 29, *P. lævis*). Of the species left, none appear to possess the typical features of Phillipsia, but on the contrary are more nearly allied to Griffithides.

Formation and locality.—Lower portion of Lower Carboniferous limestone, in cañon directly south of a small conical hill on east side of Secret-cañon-road Cañon, Eureka District, Nevada.

SYSTEMATIC LIST OF FOSSILS OF EACH GEOLOGIC FORMATION.

CAMBRIAN.

PROSPECT MOUNTAIN GROUP.

[The double multiple (××) denotes that the species passes to the group above.]

Genera and species.	Eureka.	White Pine.	Remarks.	Page.
PORIFERA.				
Protospongia fenestrata Salter	×		Type from the Cambrian of Wales	11
, sp. ?		×		
BRACHIOPODA.				
Discina, sp. ?	×		Fragment	
Lingulepis Mæra H. & W	××		Types from Eureka and White Pine Districts, Nevada	12
? minuta H. & W	××	×	Type from the Eureka District	13
Lingula ? manticula White	××		Type from Schell Creek Range, Nevada	13
Obolella discoidea H. & W	××		Type from Eureka District	14
sp. ?	×		Like O. pretiosa Billings	
Acrothele ? dichotoma, n. sp. ?	×			14
Acrotreta gemma Billings	××		Type from the Calciferous formation of Newfoundland	17
Kutorgina Prospectensis, n. sp	×			19
sculptilis Meek	×		Type from Gallatin River, Montana	20
Whitfieldi, n. sp	×			18
Leptæna Melita H. & W	××		Type from Eureka District	22
Orthis Eurekensis, n. sp	×			22
sp. ?	×	×		
PTEROPODA.				
Stenotheca elongata, n. sp	×			23
Hyolithes primordialis Hall (sp.)	×		Type from Potsdam sandstone of Wisconsin	23
Scenella ? conula, n. sp	×			15
PŒCILOPODA.				
Agnostus bidens Meek	××	×		26
communis H. & W	××	×	Type from White Pine District, Nevada	27
Neon H. & W	××		Type from Eureka District	27
prolongus H. & W	×		Type from Eureka District	28
Richmondensis, n. sp	×			24
seclusus, n. sp	×			25
Olenellus Gilberti Meek	×		Type from Pioche, Nevada	29
Howelli Meek	×		Type from Pioche, Nevada	30
Iddingsi, n. sp	×			28
Dicellocephalus ? angustifrons, n. sp	×			42
bilobatus H. & W	×		Type from Eureka District	40
? expansus, n. sp	×			45
flabellifer H. & W		L.	Geol. Expl. Fortieth Parallel, vol. iv, p. 227	
Iole, n. sp	×			43
Marica, n. sp	×			44
nasutus, n. sp	×			40
Osceola Hall	×		Type from the Potsdam sandstone of Wisconsin	40
? quadriceps H. & W	×		Type from Ute Peak, Wahsatch Range, Utah	45
Richmondensis, n. sp	×			41

CAMBRIAN—Continued.

Genera and species.	Eureka.	White Pine.	Remarks.	Page.
Ptychoparia (?) angulatus H. & W.		×	Geol. Expl. Fortieth Parallel, vol. iv, p. 220	
Anytus H. & W	×		Type from Schell Creek, Nevada	56
(S.) breviceps, n. sp	×			49
granulosus H. & W	××		Type from Eureka District	57
Haguei H. & W. (sp.)	××		Type from the White Pine District, Nevada	57
læviceps, n. sp	×			54
(?) Linnarssoni, n. sp	×			47
maculosus H. & W. (sp.)	××		Geol. Expl. Fortieth Par., vol. iv, p. 215	
nitidus H. & W. (sp.)	×		Type from Eureka District	57
occidentalis, n. sp	×			51
Oweni M. & H. (sp.)	××		Type from Big Horn Mountains, Montana	55
(?) pernasutus, n. sp	×			49
(?) Prospectensis, n. sp	×			46
(?) similis, n. sp	×			52
(?) similis, var. robustus, n. var.	×			53
unisulcatus H. & W	××		Type from Eureka District	58
(Euloma ?) affinis, n. sp	××			54
(Euloma ?) dissimilis, n. sp.	×			51
(P.) laticeps H. & W	×		Type from White Pine District, Nevada	59
(P.) occidens, n. sp	×			58
sp. ?		×		
Anomocare ? parvum, n. sp	×			59
Ptychaspis minuta Whitfield	×		Type from the Potsdam sandstone of Wisconsin	60
pustulosa H. & W		L.	Geol. Expl. Fortieth Par., vol. iv, p. 223	
Chariocephalus ? tumifrons H. & W	×	L.	Type from the White Pine District, Nevada	61
Agraulos ? globosus, n. sp	×			61
Arethusina Americana, n. sp	××			62
Ogygia ? problematica, n. sp	×			63
? spinosa, n. sp	×			63
Illænurus, sp. ?		×		

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[16] The species from the White Pine District occur at the base of the Pogonip Group and are doubtfully referred to the Cambrian.

LOWER SILURIAN.

POGONIP GROUP.

[The letter C in the first column denotes that the species also occurs in the Cambrian.]

Genera and species.	Eureka, Lower.	Eureka, Upper.	White Pine, Lower and Upper.	Remarks.	Page.
RHIZOPODA.					
Receptaculites ellipticus, n. sp		×			67
elongatus, n. sp		×			66
mammillaris Newberry		×	U.		65
HYDROZOA.					
Graptolithus, sp. ?		×		Like G. bifidus Hall	
ACTINOZOA.					
Monticulopora, sp. ?		×			
POLYZOA.					
Ptilodictya, sp. ?		×			
BRACHIOPODA.					
Lingulepis Mæra H. & W	C.			Types from the Eureka and White Pine Districts, Nevada.	12
? minuta H. & W	C.			Type from Eureka District	13
Lingula ? manticula White	C.			Type from the Schell Creek Range, Nevada	13
Lingula sp ?			L.		
Obolella ? ambigua, n. sp	×				67
discoidea H. & W	C.		L.	Type from Eureka District	14
Acrotreta gemma[17] Billings	C.		L.	Type from Calciferous Formation of Newfoundland.	17
sp. ?		×		Like A. subconica Kutorga	
Schizambon typicalis, n. sp	×				70
Leptæna melita H. & W	C.			Type from Eureka District	22
Strophomena Nemea H. & W	×		L.	Type from White Pine District, Nevada	71
Orthis Hamburgensis, n. sp		×			73
Lonensis, n. sp		×			74
perveta Conrad		×	U.	Trenton of Wisconsin, Chasy of Canada, etc	72
Pogonipensis H. & W		×	U.	Geol. Expl. Fortieth Par., vol. iv, p. 232	
testudinaria Dalman		×	U.	Trenton Group species of New York, Canada, etc.	72
tricenaria Conrad		×	U.	Trenton Group species of New York, Canada, etc.	74
sp. ?	×				
sp. ?		×	U.		
Streptorhynchus minor, n. sp		×			75
Porambonites obscurus H. & W				Geol. Expl. Fortieth Par., vol. iv, p. 234	
Triplesia calcifera Billings	×			Calciferous formation of Canada*	75
LAMELLIBRANCHIATA.					
Tellinomya contracta Salter ?		×	U.	Trenton Group species	76
? Hamburgensis, n. sp		×			76
Modiolopsis occidens, n. sp		×	U.		77
Pogonipensis, n. sp		×	U.		78
sp. ?			U.		

[17] Identified by Mr. Meek from Malade City, Utah. Hayden's Report for 1872, p. 464.

LOWER SILURIAN—Continued.

Genera and species.	Eureka, Lower.	Eureka, Upper.	White Pine, Lower and Upper.	Remarks.	Page.
GASTEROPODA.					
Bellerophon (Bucania) bidorsata Hall			U.	Trenton Group species in New York, Canada, etc.	
sp. ?		×		Like B. allegoricus White	
Straparollus, sp. ?			U.		
Raphistoma Nasoni Hall (sp.)		×		Trenton Group of Wisconsin	78
sp. ?		×			
Murchisonia Milleri Hall			U.	Trenton Group species in New York, Canada, etc.	79
sp. ?		×			
sp. ?			U.		
Pleurotomaria Lonensis, n. sp		×	U.		80
sp. ?		×			
Helicotoma, sp. ?		×			81
Maclurea annulata, n. sp		×	U.		81
carinata, n. sp		×			82
subannulata, n. sp		×			82
sp. ?		×			83
Metoptoma ? analoga, n. sp			U.		84
Phillipsi, n. sp			U.		83
Cyrtolites sinuatus H. & W		×		Type from the White Pine District, Nevada	84
PTEROPODA.					
Coleoprion minuta, n. sp		×	U.		85
Hyolithes Vanuxemi, n. sp		×			85
sp. ?			U.		
CEPHALOPODA.					
Orthoceras multicameratum Hall		×	U.	A species of the Lower Trenton in New York	86
4 sp. ?			U.		86, 87
Endoceras (like E. multitubulatum)		×		Species of Lower Trenton in New York State	87
proteiforme Hall		×		Trenton Group species	86
CRUSTACEA.					
Leperditia bivia White		×		Type from the Schell Creek Range, Nevada	88
sp. ?		×			88
Beyrichia, sp. ?		×			88
Plumulites, sp. ?		×			88
PŒCILOPODA.					
Agnostus communis H. & W	C.			Type from White Pine District, Nevada	27
tumidosus H. & W	×			Geol. Expl. Fortieth Par., vol. iv. p. 231	
Dicellocephalus inexpectans, n. sp	×				90
finalis, n. sp		×			89
multicinctus H. & W	×			Geol. Expl. Fortieth Par., vol. iv, p. 226	
Ptycoparia annectans, n. sp	×				91
granulosus H. & W. (sp.)	C.			Type from Eureka District	57
Haguei H. & W. (sp.)	C.			Type from the White Pine District	57
maculosus H. & W. (sp.)	C.			Geol. Expl. Fortieth Par., vol. iv, p. 215	
Oweni Meek	C.			Type from Big Horn Mountains, Montana	55
unisulcatus H. & W. (sp.)	C.				58
(Euloma ?) affinis, n. sp. ?	C.		L.		54

LOWER SILURIAN—Continued.

Genera and species.	Eureka, Lower.	Eureka, Upper.	White Pine, Lower and Upper.	Remarks.	Page.
Arethusina Americana, n. sp	C.				62
Bathyurus ? congeneris, n. sp		×			92
Pogonipensis H. & W			U.	Geol. Expl. Fortieth Par., vol. iv, p. 248	
? simillimus, n. sp		×			93
? tuberculatus, n. sp		×	U.		91
? sp. ?			U.		
Cyphaspis ? brevimarginatus, n. sp		×			93
Amphion Nevadensis, n. sp		×	U.		94
sp. ?		×			
sp. ?			U.		
Ceraurus, sp. ?		×			95
Symphysurus ? Goldfussi, n. sp		×			95
Barrandia ? McCoyi, n. sp		×			96
? sp		×			96
Illænurus Eurekensis, n. sp	×		L.		97
Illænus crassicauda Wahlenberg (sp.)			U.	Very abundant in Upper Pogonip	
sp. ?		×			
Asaphus Caribouensis, n. sp		×			98
? curiosus Billings		×		Type from the Quebec Group of Canada	98
3 sp. ?		×			

LONE MOUNTAIN SILURIAN.

Genera and species.	Lower Silurian.	Upper Silurian.	White Pine.	Remarks.	Page.
ACTINOZOA.					
Streptelasma, n. sp	×				
, sp. ?	×				
Zaphrentis ? sp. ?		×			
Halysites catenulatus Linn (sp.)		×	U.		
Monticulopora, sp. ?	×				
ECHINODERMATA.					
Cystid	×			Separate plates	
BRACHIOPODA.					
Leptæna sericea Sowerby	×				
Orthis	×			Like O. plicatella	
CEPHALOPODA.					
Orthoceras, sp. ?	×				
Cyrtoceras, sp. ?	×				
PŒCILOPODA.					
Ceraurus	×				
Dalmanites	×				
Trinucleus concentricus Murch.	×				
Illænus					
Asaphus platycephalus Stokes	×				

DEVONIAN.

ABBREVIATIONS.—Up. Held. = Upper Helderberg. Ham. = Hamilton Group Ch. = Chemung Group of the Devonian series of the Geological Survey of New York. H. & W. = Hall & Whitfield, Geol. Expl. Fortieth Parallel, vol. iv, 1877.

Genera and species.	Lower.	Upper.	White Pine, Upper.	Remarks.	Page.
PORIFERA.					
Palæomanon Roemeri, n. sp	×				99
Astylospongia, sp. ?	×				99
Stromatopora, sp. ?	×	×			100
ACTINOZOA.					
Fistulipora, sp. ?	×				101
Favosites hemispherica, Y. & S.	×			Up. Held. and Ham. of New York and Canada; Up. Held. Falls of Ohio.	100
basaltica, var.	×				100
, n. sp	×				101
Alveolites multilamellata Meek			×	Geol. Expl. Fortieth Par., vol. iv, p. 25	
Rockfordensis Hall ?		×		Type from Devonian of Iowa	102
Cladopora prolifica Hall			×	Up. Held. of New York and Falls of Ohio	
pulchra Rominger ?		×		Up. Held. of New York and Falls of Ohio	102
, sp. ?	×			Up. Held. of New York and Falls of Ohio	102
Thecia ramosa Rominger ?	×			Up. Held. of New York and Falls of Ohio	102
Syringopora Hisingeri Billings		×		Up. Held. of New York and Falls of Ohio	103
perelegans Billings	×	×			103
Aulopora serpens Goldfuss	×			Ham. of Michigan	103
Cyathophyllum corniculum M. Ed.		×		Up. Held. of New York, Canada, Falls of Ohio, etc.	104
Davidsoni M. Ed.	×			Hamilton of Iowa	104
rugosum M. Ed. & Haime	×			Up. Held. of New York, Falls of Ohio, etc	104
, 2 n. sp	×				104
, sp. ?			×		105
Acervularia pentagona Goldfuss		×	×	Identified by Meek, from White Pine Dist., Nevada.	105
Smithia Hennahii Lonsdale (sp.)			×	Geol. Expl. Fortieth Par., vol. iv, p. 32	
Pachyphyllum Woodmani White, sp		×		Devonian of Iowa	105
Diphyphyllum Simcoense M. Ed.	×		×	Up. Held of New York, Falls of Ohio, etc	105
Ptychophyllum ? infundibulum Meek			×	Geol. Expl. Fortieth Par., vol. iv, p. 28	
Cystiphyllum Americanum M. Ed.	×			Up. Held. New York, Falls of Ohio, etc.; Ham. of New York, etc.	106
, 2 n. sp	×				106
POLYZOA.					
Fenestella, 2 sp. ?	×				
Thamniscus ? sp. ?	×				
BRACHIOPODA.					
Lingula Alba-pinensis, n. sp			×		108
Læna Hall	×			Ham. Group of New York	106
Ligea Hall		×		Ham. Group of New York..	107
Ligea, var. Nevadensis, n. var		×			107
Lonensis, n. sp	×				108
Melie Hall	×			Pal. N. Y., vol. iv, p. 14	
Whitei, n. sp	×				109
, sp ?			×		
Discina Lodensis Hall			×	Ham. of New York	112
minuta Hall ?		×		Ham. of New York	113
, sp. ?	×				112

DEVONIAN—Continued.

Genera and species.	Lower.	Upper.	White Pine, Upper.	Remarks.	Page.
Pholidops bellula, n. sp	×				113
quadrangularis, n. sp	×				114
Orthis impressa Hall	×		×	Ch. of New York	115
McFarlanei Meek	×		×	Type from Mackenzie River, British America	114
Tulliensis Vanuxem		×		Ham. of New York	115
Skenidium Devonicum, n. sp	×				116
Streptorhynchus Chemungensis Conrad (sp.)	×			Up. Held., Ham., and Ch. of New York	117
Chemungensis, var. Pandora Billings.	×	×		Up. Held. of New York and Canada	117
Chemungensis, var., perversa Hall.	×			Up. Held. and Ham. of New York	117
Strophomena rhomboidalis Wilckens (sp.)	×			Up. Held., New York, Falls of Ohio, etc	118
Strophodonta arcuata Hall	×			Devonian of Iowa	121
Calvini Miller	×			Devonian of Iowa	122
canace H. & W	×		×	Geol. Expl. Fortieth Par., vol. iv, p. 246, 1877	
demissa Conrad (sp.)	×			Devonian of Iowa, New York, etc.; Mackenzie River, B. A.	118
inequiradiata Hall	×		×	Up. Held. of New York	120
Patersoni Hall	×			Up. Held. of New York	119
perplana Conrad, (sp.)	×	×		Throughout the Devonian of New York	120
punctulifera Conrad (sp.)	×			Throughout the Devonian of New York	121
Chonetes deflecta Hall	×	×		Ham. of New York	124
filistriata, n. sp	×				127
hemispherica Hall	×			Up. Held. of New York	123
macrostriata, n. sp	×				126
mucronata Hall		×		Up. Held. of New York, etc.; Great Bear Lake, B. A.	124
setigera Hall	×			Ham. of New York, etc	125
, sp. ?			×		
Productus (P.) Hallanus, n. sp	×	×		Devonian of Iowa	130
(P.) hirsutiforme, n. sp			×		133
(P.) lachrymosus Conrad (sp.)		×			132
(P.) lachrymosus, var., limus Conrad (sp.)		×		Ch. of New York	132
(P.) lachrymosus, var., stigmatus Hall.		×		Ch. of New York	132
(P.) navicellus Hall	×			Up. Held. and Ham. of New York	181
(P.) Shumardianus Hall	×	×		Devonian of Iowa	129
(P.) Shumardianus, var., pyxidatus Hall.	×	×		Devonian of Iowa	129
(P.) speciosus Hall		×		Ch. of New York	133
(P.) subaculeatus Murch	×	×	×	Up. Held. Falls of Ohio	128
(P.) truncatus Hall	×			Ham. of New York	131
, sp. ?			×	Of the type of P. semireticulatus	
Spirifera Alba-pinensis H. & W			×	Geol. Expl. Fortieth Par., vol. iv, p. 255	
disjuncta Sowerby		×	×	Ch. of New York, Mackensie River, B. A., etc	184
Englemanni Meek ?		×	×	Type, Eureka and White Pine Districts, Nevada	138
Parryana Hall ?	×			Devonian of Iowa and Canada	137
Piñonensis Meek	×	×	×	Type, Piñon Range, Nevada	138
raricosta Conrad, (sp.)	×			Up. Held. of New York, Falls of Ohio, etc	135
strigosus Meek			×	Geol. Expl. Fortieth Par., vol. iv, p. 43	
Spirifera varicosa Hall	×			Up. Held. of New York, Falls of Ohio, etc	136
sp. undt	×				137

DEVONIAN—Continued.

Genera and species.	Lower.	Upper.	White Pine, Upper.	Remarks.	Page.
(M.) glabra, var., Nevadensis, n. var.		×			139
(M.) Maia Billings	×	×		Up. Held. of New York and Canada	141
(M.) undifera Rœmer	×				143
Spiriferina cristata Schlotheim (sp.)			×	Also in Carboniferous	218
Ambocœlia umbonata Conrad (sp.)			×	Ham. Group of New York	
Cyrtina Davidsoni, n. sp.			×		146
Hamiltonensis Hall		×			147
Nucleospira concinna Hall	×			Up. Held. and Ham. of New York	147
Trematospira infrequens, n. sp	×				151
Retzia radialis Phillips (sp.)			×	Also in Carboniferous	220
Athyris Angelica Hall		×		Ch. of New York	148
sp. ?			×	Of the type of Athyris plano-sulcata	
sp. ?	×				148
Meristella (W.) nasuta Conrad (sp.)	×			Up. Held. of New York	148
Atrypa desquamata Sowerby	×			Devonian of England	150
reticularis Linn. (sp.)	×	×	×	Devonian of America, Europe, etc	150
Rhynchonella castanea Meek	×	×		Type from Mackenzie River, B. A	153
duplicata Hall		×	×	Chemung of New York	155
Emmonsi H. & W			×	Geol. Expl. Fortieth Par., vol. iv, p 247	157
Horsfordi Hall	×			Hamilton of New York	152
pugnus Martin		×		Devonian of Ohio, New York, and England	155
? occidens, n. sp	×		×		152
quadricosta Hall			×	Genesee Slate of New York	
Tethys Billings	×			Up. Held. of Canada and Falls of Ohio	152
(L.) Laura Billings		×		Ham. of Canada and New York	159
(L.) Nevadensis, n. sp		×			157
(L.) sinuatus Hall		×		Chemung of New York	158
Leptocœlia, sp. ?	×			Not unlike L. acutiplicata Hall	
Pentamerus comis Owen (sp.)	×			Ham. and Chemung of Iowa	159
Lotis, n. sp			×		161
Tropidoleptus carinatus Hall	×			Found in Piñon Range, Nevada	
Cryptonella ? circula, n. sp	×		×		163
Piñonensis, n. sp		×			163
Terebratula, sp. ?			×		
LAMELLIBRANCHIATA.					
Aviculopecten ? catactus Meek			×	Geol. Expl. Fortieth Par., vol. iv, p. 93	
Pterinopecten, sp. ?			×		
Glyptodesma, sp. ?		×			
Pterinea Newarkensis, n. sp		×			165
flabella Conrad	×			Upper Held. to Chemung of New York	165
Actinopteria Boydi Conrad (sp.)	×			Ham. Group of New York	166
Leiopteria Rafinesquii Hall	×			Ham. Group of New York	166
Leptodesma transversa n. sp		×			167
Limoptera sarmenticia, n. sp	×				167
Mytilarca dubia, n. sp	×				168
Chemungensis Conrad (sp.)		×		Chemung Group of New York	168
sp. ?	×				
(Plethomytilus) oviformis Conrad (sp.)	×			Ham. Group of New York	169
Modiomorpha altiforme, n. sp	×				169
oblonga, n. sp	×				170

DEVONIAN—Continued.

Genera and species.	Lower.	Upper.	White Pine, Upper.	Remarks.	Page.
Modiomorpha obtusa, n. sp	×				171
Goniophora perangulata Hall	×			Schoharie Grit of New York	171
Palæoneilo, sp. ?		×			
Nucula Rescuensis, n. sp		×			172
, sp. ?		×			172
Nuculites triangulus H. & W			×	Geol. Expl. Fortieth Par., vol. iv, p. 248	
Dystactella insularis, n. sp	×				172
Megambonia occidualis, n. sp	×				173
Nyassa parva, n. sp	×	×			173
Grammysia minor, n. sp		×			174
Edmondia Piñonensis Meek	×			Geol. Expl. Fortieth Par., vol. iv, p. 46	
Sanguinolites ? Combensis, n. sp	×				175
? gracilis, n. sp	×				175
rigidus White & Whitfield (sp.).		×		Chemung of New York, Burlington Sandstone of Iowa.	176
? Sanduskyensis Meek	×			Upper Held. of Ohio	176
ventricosus White & Whitfield (sp.).		×		Chemung of New York, Burlington Sandstone of Iowa.	177
Conocardium Nevadensis, n. sp	×				177
, sp	×				
Lunulicardium fragosum Meek (sp.)			×	Geol. Expl. Fortieth Par., vol. iv, p. 92	
Paracyclas occidentalis	×	×			178
peroccidens H. & W			×	Geol. Expl. Fortieth Par., vol. iv, p. 248	
Posidonomya Devonica, n. sp	×				179
lævis, n. sp	×				178
Microdon (C.) macrostriatus, n. sp	×				180
Cardiomorpha Missouriensis Swallow			×	Geol. Expl. Fortieth Par., vol. iv, p. 277	
Anadontopsis amygdalæformis, n. sp	×				180
Schizodus (Cytherodon) orbicularis, n. sp	×				181
Cypricardinia indenta Conrad, (sp.)	×			Upper Held. of New York and the Falls of the Ohio.	182
GASTEROPODA.					
Platyceras carinatum, Hall	×			Up. Held. and Ham. of New York	182
conicum Hall	×			Up. Held. and Ham. of New York, and Up. Held. Falls of the Ohio.	182
Conradi, n. sp	×				182
dentalium Hall	×			Up. Held. of New York	182
nodosum Conrad	×			Up. Held. of New York	183
thetiforme, n. sp	×				184
Thetis Hall	×			Up. Held. and Ham. of New York	182
undulatum, n. sp	×				184
Platyostoma lineatum Conrad	×			Up. Held. and Ham. of New York, Canada, etc	185
sp. ?		×			
Ecculiomphalus Devonicus, n. sp	×				187
Euomphalus Eurekensis, n. sp	×				185
(P.)laxus Hall		×	×	Upper Held. and Ham. of New York	186
sp. ?	×				
sp. ?			×		
Straparollus Newarkensis, n. sp		M.			187
Pleurotomaria, sp. ?			×		
Platyschisma ? ambiguum, n. sp		M.			188
? McCoyi, n. sp		M.			188
sp. ?			×		

DEVONIAN—Continued.

Genera and species.	Lower.	Upper.	White Pine, Upper.	Remarks.	Page.
Calonema occidentalis, n. sp	×				189
Loxonema approximatum, n. sp	×				191
Eurekensis, n. sp	×				190
nobile, n. sp	×				190
? subattenuatum Hall	×			Up. Held. of New York	191
(2 sp.?)	×				192
sp.?			×		
Bellerophon Combei, n. sp	×				193
Leda Hall		M.		Ham. of New York	194
Lyra Hall		M.		Ham. of New York	194
Mæra Hall		×		Ch. of New York	194
Neleus H. & W	×		×	Geol. Expl. Fortieth Par., vol. iv, p. 250	
Pelops Hall		M.		Up. Held. of New York	194
perplexa, n. sp	×				193
Scoliostoma Americana, n. sp	×				195
Naticopsis (like N. æquistriata)		×			
sp.?		×			
sp.?			×		
Metoptoma? Devonica, n. sp	×				195
PTEROPODA.					
Tentaculites attenuatus Hall	×			Ham. of New York and Canada	197
bellulus Hall?	×			Ham. of New York and Canada	197
gracilistriatus Hall	×			Ham. of New York and Canada	196
scalariformis Hall	×			Up. Held. of New York	197
Styliola fissurella Hall	×	×		Ham. of New York and Canada	197
var. intermittens Hall		×			197
Conularia (sp.?)	×				198
Coleolus lævis, n. sp		×			199
Hyolithes (like H. Aclis Hall)	×				199
CEPHALOPODA.					
Orthoceras (5 sp.?)	×				200
Gomphoceras suboviforme, n. sp		×			202
Cyrtoceras cessator H. & W			×	Geol. Expl. Fortieth Par., vol. iv, p. 278	
Nevadense, n. sp	×				203
Goniatites desideratus, n. sp	×				203
Kingi H. & W			×	Geol. Expl. Fortieth Par., vol. iv, p. 279	
sp.?		×		Like (G. discoideus Hall)	
CRUSTACEA.					
Beyrichia occidentalis n. sp	×				204
Leperditia rotundata, n. sp	×				206
PŒCILOPODA.					
Phacops rana Green (sp.)	×			Up. Held. and Ham. of New York, Canada, etc	207
Dalmanites Meeki, n. sp	×				208
sp.?	×				210
Proetus Haldemani Hall		M.		Ham. of New York	210
marginalis Conrad (sp.)	×			Up. Held. of New York	210
sp.?			×		
Phillipsia coronata Hall?		M.		Ham. of New York	211

CARBONIFEROUS.

Genera and species.	Lower.	Upper.	Remarks.	Page.
RHIZOPODA.				
Fusilina cylindrica Fischer	×	×		
robusta Meek	×	×		
PORIFERA.				
Stromatopora, sp.?	×			
ACTINOZOA.				
Zaphrentis, sp.?		×		
Syringopora multattenuata?	×		McChesney, sp	
Chætetes 3 sp.?		×		
ECHINODERMATA.				
Archæocidaris 2 sp.?	×			212
POLYZOA.				
Polypora, sp.?		×		
sp.?	×			
Ptilodictya (S.) carbonaria Meek?		×	Coal Measures of Ohio	
(S.) serrata Meek?		×	Coal Measures of Ohio	
sp.?	×			
Fenestella 3 sp.?	×			
BRACHIOPODA.				
Discina connata, n. sp	×			214
Newberryi Hall	×		A species of the Waverly sandstone of Ohio	213
nitida Phillips (sp.)	×			213
sp.?	×			
Lingula mytiloides Sowerby?	×			
Chonetes granulifera Owen	×		U. S. Geol. Surv. Nebraska, p. 170, 1872	
Verneuiliana N. & P.	×		U. S. Geol. Surv. Nebraska, p. 170, 1872	
Productus costatus Sowerby	×		Geol. Expl. Fortieth Par., vol. iv, p. 69, 1877	
elegans McCoy	×			
longispinus Sowerby	×	×	Geol. Expl. Fortieth Par., vol. iv, p. 78, 1877	
longispinus, var. muricatus N. & P.	×			
Nebrascensis Owen	×	×	Expl. & Surv. W. 100th Merid., vol. iv, Pal., p. 116, 1875	
Prattenianus Norwood	×	×	Geol. Expl. Fortieth Par., vol. iv, p. 72, 1877	
punctatus Martin (sp.)		×	Expl. & Surv. W. 100th Merid., vol. iv, Pal., p. 114, 1875	
semireticulatus Martin (sp.)	×	×	Geol. Expl. Fortieth Par., vol. iv, p. 69, 1877	
subaculeatus Murch	×		Also in Devonian	214
Strophomena rhomboidalis Linn. (sp.)	×			118
Streptorhynchus crenistria Phillips (sp.)	×			
Orthis Pecosi Marcou		×	Expl. & Surv. W. 100th Merid., Pal., vol. iv, p. 125, 1875	
resupinata Martin (sp.)	×		Geol. Expl. Fortieth Par., vol. iv, p. 265, 1877	
Spirifera annectans, n. sp	×			216
camerata Martin	×	×	Geol. Expl. Fortieth Par., vol. iv, p. 91, 1877	
desiderata, n. sp	×			217
Leidyi N. & P	×			216
neglecta Hall	×			217
Rockymontana Marcou	×	×	Expl. & Surv. W. 100th Merid., vol. iv, Pal., p. 134, 1875	
striata Martin	×		Geol. Expl. Fortieth Par., vol. iv, p. 269, 1877	
trigonalis Martin (sp.)	×			215
(Martinia) setigera Hall	×		Geol. Expl. Fortieth Par., vol. iv, p. 270, 1877	

CARBONIFEROUS—Continued.

Genera and species.	Lower.	Upper.	Remarks.	Page.
Syringothyris cuspidatus Martin (sp.)	×		Davidson's Monograph Carb. Brachiopoda	219
Spiriferina cristata Schlotheim (sp.)	×	×	Also in Devonian	218
Retzia radialis Phillips	×	×		220
Athyris Royssii L'Eveillé (sp.)	×		Geol. Expl. Fortieth Par., vol. iv, p. 82, 1877	
hirsuta Hall	×			222
subtilita Hall (sp.)	×	×		
Rhynchonella Eurekensis, n. sp	×			223
Thera, n. sp	×			223
sp.?	×		Leiorhynchus-like	
Camarophoria Cooperensis Shumard	×			224
Terebratula bovidens Martin		×	Expl. & Surv. W. 100th Merid., vol. iv, Pal., p. 144, 1875	
hastata Sowerby	×			224
LAMELLIBRANCHIATA.				
Aviculopecten affinis, n. sp	×			229
Eurekensis, n. sp	×			227
Haguei, n. sp	×			226
peroccidens, n. sp	×			227
Pintöensis, n. sp	×			228
2 sp.?	×			230
Streblopteria similis, n. sp	×			230
Crenipecten Hallanus, n. sp	×			231
Pterinopecten Hoosacensis, n. sp	×			232
Spio, n. sp	×			233
Pterinea Pintöensis, n. sp	×			234
Leptodesma (2 sp.?)	×			234
Ptychopteria protoformis, n. sp				235
Pinna consimilis, n. sp	×			236
inexpectaus, n. sp	×			235
Myalina congeneris, n. sp	×			237
Nemesis, n. sp	×			237
Nessus, n. sp	×			238
Modiola? Nevadensis, n. sp	×			239
Modiomorpha ambigua, n. sp	×			239
? desiderata, n. sp	×			240
? Pintöensis, n. sp	×			240
Nucula insularis, n. sp	×			241
levatiforme, n. sp	×			241
Solenomya curta, n. sp	×			242
Macrodon Hamiltonæ Hall	×		Ham. group of New York	243
truncatus, n. sp	×			243
tennistriatus Meek & Worthen		×	Geol. Ill., vol. v, p. 576, 1873	
Grammysia arcuata Conrad, (sp.)	×		Ham. Group of New York	245
Hannibalensis Shumard (sp.)	×			244
Edmondia ? circularis, n. sp	×			246
Medon, n. sp	×			245
Pleurophorus Meeki, n. sp	×			246
Sanguinolites Æolus Hall	×		Waverly of Ohio	247
? Nænia, n. sp	×			249
retusus, n. sp	×			247
Salteri, n. sp	×			248
simplex, n. sp	×			248
striata, n. sp	×			249
Microdon (Cypricardella) connatus, n. sp	×			250

CARBONIFEROUS—Continued.

Genera and species.	Lower.	Upper.	Remarks.	Page.
Cardiola? filicostata, n. sp	×			251
Schizodus cuneatus Meek	×		Coal Measures of Ohio	252
curtiforme, n. sp	×			253
deparcus	×			252
Pintöensis, n. sp	×			253
GASTEROPODA.				
Platyceras occidens, n. sp	×			254
Piso, n. sp	×			254
Platyostoma inornatum, n. sp	×			255
Euomphalus (S.) subrugosus M. & W	×			255
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sp.?		×		
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sp.?	×		Like B. ellipticus McChesney	
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PALEOZOIC SECTION IN CENTRAL NEVADA.

The geologic portion of the accompanying section is taken from the "Abstract of Report on the Geology of the Eureka District, Nevada, by Arnold Hague," contained in the Third Annual Report of the Director of the United States Geological Survey, p. 253. It is introduced to enable the student at a glance to locate in the geologic section the position of any portion of the Paleozoic fauna described in the preceding list.

All of the Cambrian fauna is included under the head of "Prospect Mountain Group," in the systematic list.

The Lower Silurian includes the fauna of the Pogonip limestone and the base of the Lone Mountain limestone, only two or three species of corals indicating the presence of an Upper Silurian fauna.

The Devonian limestones are highly fossiliferous throughout. The fauna is best preserved within 500 feet of the base and summit, the massive beds of the central portions yielding but very few good specimens.

The White Pine shales in the Eureka District gave but two identified species and fragments of ten others referred to genera. In the White Pine District the fauna is scattered through the shale and embraces fourteen named species and eleven referred to genera.

The large fauna of the Lower Carboniferous occurs within a range of 500 feet above the summit of the Diamond Peak quartzite. Only 24 of the 132 species of the Carboniferous fauna occur above that horizon, and of these 10 are present in the lower beds.

Paleozoic section of Nevada,

CARBONIFEROUS, 9,300 feet.	Upper Carboniferous	500	Light-colored blue and drab limestones
	Weber conglomerate	2,000	Coarse and fine conglomerates; layers of reddish yellow sandstone
	Lower Carboniferous	3,800	Heavy-bedded dark blue and gray limestone, with intercalated bands of chert; argillaceous beds near the base.
	Diamond Peak quartzite	3,000	Massive gray and brown quartzite; with brown and green shales at the summit. The quartzite is largely a fine quartzitic conglomerate formed of small, dark jaspery pebbles and light quartz pebbles in a grayish matrix.
DEVONIAN, 8,000 feet.	White pine shale	2,000	Black argillaceous shales, more or less arenaceous, with intercalations of red, and reddish brown friable sandstone, changing rapidly with the locality; plant impressions.
	Nevada limestone	6,000	Lower horizons indistinctly bedded, saccharoidal texture, gray color, passing up into strata distinctly bedded, brown, reddish-brown and gray in color, frequently finely striped, producing a variegated appearance. The upper horizons are massive, well-bedded, and bluish-black in color; highly fossiliferous.
SILURIAN, 5,000 feet.	Lone Mountain limestone	1,800	Black, gritty beds at the base, passing into a light gray siliceous rock, with all traces of bedding obliterated; Trenton fossils at the base; Halysites in the lower portion.
	Eureka quartzite	500	Compact vitreous quartzite, white, blue, passing into reddish tints near the base; indistinct bedding.
	Pogonip limestone	2,700	Interstratified limestone, argillites, and arenaceous beds at the base, passing into purer, fine-grained limestone of a bluish gray color, distinctly bedded; highly fossiliferous.
CAMBRIAN, 7,700.	Hamburg shale	350	Yellow argillaceous shale, layers of chert nodules throughout the bed, but more abundant near the top.
	Hamburg limestone	1,200	Dark gray and granular limestone; surface weathering, rough and ragged; only slight traces of bedding.
	Secret Cañon shale	1,600	Yellow and gray argillaceous shales, passing into shaly limestone; near the top, interstratified layers of shale and thinly bedded limestones.
	Prospect Mountain limestone	3,050	Gray, compact limestone; lighter in color than the Hamburgh limestone, traversed with thin seams of calcite; bedding planes very imperfect.
	Prospect Mountain quartzite	1,500	Bedded brownish white quartzites, weathering dark brown; ferruginous near the base; intercalated thin layers of arenaceous shales; beds whiter near the summit.

NOTE.—Plane of unconformity indicated by double dividing line.

Vertical range of genera.

Upper Carboniferous genera: Fusilina, Zaphrentis, Polypora, Ptylodictya, Chætetes, Orthis, Productus, Spirifera, Spiriferina, Retzia, Athyris, Terebratula, Myalina, Macrodon, Pleurotomaria.

Non-fossiliferous.

Lower Carboniferous genera: Fusilina, Stromatopora, Syringopora, Polypora, Ptilodictya, Fenestella, Archæocidaris, Lingula, Discina, Streptorhynchus, Orthis, Chonetes, Productus, Strophomena, Spirifera, Syringothyris, Spiriferina, Athyris, Rynchonella, Camarophoria, Terebratula, Aviculopecten, Streblopteria, Crenipecten, Pterinopecten, Pterinea, Leptodesma, Ptychopteria, Pinna, Myalina, Modiola, Modiomorpha, Nucula, Solenomya, Macrodon, Grammysia, Edmondia, Pleurophorus, Sanguinolites, Microdon, Cardiola, Schizodus, Platyceras, Platyostoma, Bellerophon, Euomphalus, Loxonema, Macrocheilus, Pleurotomaria, Naticopsis, Metoptoma, Hyolithes, Dentalium, Conularia, Orthoceras, Gomphoceras, Nautilus, Leperditia, Griffithides.

Productus and Athyris alone observed in a calcareous stratum near the base of the conglomerate beds, not over 200 feet above the White Pine shale.

Fauna mostly in central and upper portion: Cyathophyllum, Fenestella, Lingula, Discina, Orthis, Chonetes, Productus, Spirifera, Ambocœlia, Retzia, Athyris, Rhynchonella, Aviculopecten, Modiomorpha, Palæoneilo, Nuculites, Cardiomorpha, Lunulicardium, Cypricardinia, Conocardium, Hyolithes, Pleurotomaria, Goniatites, Cyrtoceras, Proetus.

Upper 500 feet: Stromatopora, Alveolites, Cladopora, Syringopora, Cyathophyllum, Pachyphyllum, Lingula, Discina, Orthis, Streptorhynchus, Strophodonta, Chonetes, Productus, Spirifera, Athyris, Atrypa, Rhynchonella, Cryptonella, Pterinea, Leptodesma, Mytilarca, Nucula, Nyassa, Grammysia, Sanguinolites, Paracyclas, Euomphalus, Straparollus, Platyschisma, Bellerophon, Naticopsis, Styliola, Coleolus, Gomphoceras, Proetus, Phillipsia?.

Lower 500 feet: Palæomanon, Astylospongia, Stromatopora, Favosites, Thecia, Syringopora, Aulopora, Cyathophyllum, Acervularia, Diphyphyllum, Cystiphyllum, Lingula, Discina, Pholidops, Orthis, Skenidium, Streptorhynchus, Strophomena, Strophodonta, Chonetes, Productus, Spirifera, Trematospira, Nucleospira, Meristella, Atrypa, Rhynchonella, Pentamerus, Cryptonella, Glyptodesma, Pterinea, Actinopteria, Leiopteria, Limoptera, Mytilarca, Plethomytilus, Modiomorpha, Goniophora, Dystactella, Megambonia, Nyassa, Edmondia, Sanguinolites, Conocardium, Paracyclas, Posidonomya, Microdon, Anadontopsis, Schizodus, Cypricardinia, Platyceras, Platyostoma, Ecculiomphalus, Euomphalus, Callonema, Loxonema, Bellerophon, Metoptoma, Tentaculites, Styliola, Hyolithes, Orthoceras, Cyrtoceras, Goniatites, Beyrichia, Leperditia, Phacops, Proetus, Dalmanites.

Upper Silurian horizon: Zaphrentis, Halysites.

Lower beds: Streptelasma, Monticulopora, Leptæna, Orthis, Orthoceras, Cyrtoceras, Ceraurus, Trinucleus, Dalmanites, Illænus, Asaphus.

Non-fossiliferous.

Upper portion: Receptaculites, Monticulopora, Ptilodictya, Graptolithus, Acrotreta, Strophomena, Streptorhynchus, Orthis, Triplesia, Modiolopsis, Tellinomya, Bellerophon, Murchisonia, Raphistoma, Pleurotomaria, Hellicotoma, Maclurea, Cyrtolites, Coleoprion, Hyolithes, Orthoceras, Endoceras, Leperditia, Beyrichia, Amphion, Ceraurus, Symphasurus, Cyphaspis, Proetus, Illænus, Bathyurus, Asaphus.

Lower portion: Lingulepis, Lingula?, Discina, Obolella, Acrotreta, Schizambon, Leptæna, Strophomena, Orthis, Triplesia, Agnostus, Dicellocephalus, Ptychoparia, Arethusina, Illænurus, Asaphus.

Lingulepis, Kutorgina, Obolella, Acrotreta, Agnostus, Dicellocephalus, Ptychoparia, Ptychaspis, Arethusina.

Traces of fossils.

Upper beds: Protospongia, Lingulepis, Lingula?, Discina, Acrothele, Acrotreta, Kurtorgina, Hyolithes, Agnostus, Dicellocephalus, Ptychoparia, Agraulos, Chariocephalus, Ogygia?.

Upper beds: Lingulepis, Obolella, Stenotheca, Agnostus, Dicellocephalus, Ptychoparia.
Middle beds: Scenella, Agnostus, Dicellocephalus?, Ptychoparia.

Upper shaly beds: Kutorgina, Olenellus, Ptychoparia, Anomocare.

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PLATE I.

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ACROTRETA GEMMA 17

Fig. 1*a*. View of the posterior side of the ventral valve, enlarged to six diameters.
1*b*. Cast of the interior of the apex of the ventral valve, showing a cast of the siphonal tube and the elongate muscular scars, enlarged to six diameters.
1*c*. Interior of the dorsal valve of *Obolella ? Soabrinæ* Callaway (after Davidson).
1*d*. Interior of ventral valve enlarged to six diameters.
1*e*. Exterior of a small dorsal valve, enlarged to six diameters.
1*f*. Interior of apex of ventral valve.
See plate ix, figs. 9, 9*a*.

OBOLELLA ? AMBIGUA 67

Fig. 2*a*. Dorsal valve with the central portion of the shell exfoliated so as to show the median muscular scars, enlarged to three diameters.
2*b*. Exterior of ventral valve, enlarged to three diameters.
2*c*. Interior of dorsal valve, enlarged to three diameters.

SCHIZAMBON TYPICALIS 70

Fig. 3. Interior of ventral valve, enlarged to six diameters.
3*a*. Exterior of ventral valve, enlarged to six diameters.
3*b*. Interior of dorsal valve, enlarged to six diameters.
3*c*. Exterior of dorsal valve, enlarged to six diameters.
3*d*. A portion of the surface of fig. 3*c*, enlarged to show the minute surface spines.

METOPTOMA PHILLIPSI 83

Fig. 4. View looking from above. Natural size.
4*a*. Side view of same specimen.

MODIOLOPSIS OCCIDENS 77

Fig. 5. Cast of the right valve. See plate xi, figs. 14, 14*a*.

MODIOLOPSIS POGONIPENSIS 78

Fig. 6. Cast of the left valve. See plate xi, fig. 13.

KUTORGINA SCULPTILIS 20

Fig. 7. Upper surface of ventral valve, enlarged to six diameters. This figure is drawn from the type specimen from Montana, described by Mr. Meek.
7*a*. Posterior view of the same to show elevation, area, and deltidial opening.
7*b*. Enlargement to six diameters of a specimen from the Eureka District. See plate ix, fig. 7.

SIPHONOTRETA UNGUICULATA 69

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PTYCHOPARIA ? SIMILIS, var. ROBUSTUS 53

Fig. 9. View of the central portion of the head. Natural size.
9*a*. Outline of profile view of the same.

DICELLOCEPHALUS INEXPECTANS 90

Fig. 10. Central portions of the head of a small specimen. Natural size.

METOPTOMA ? ANALOGA 84

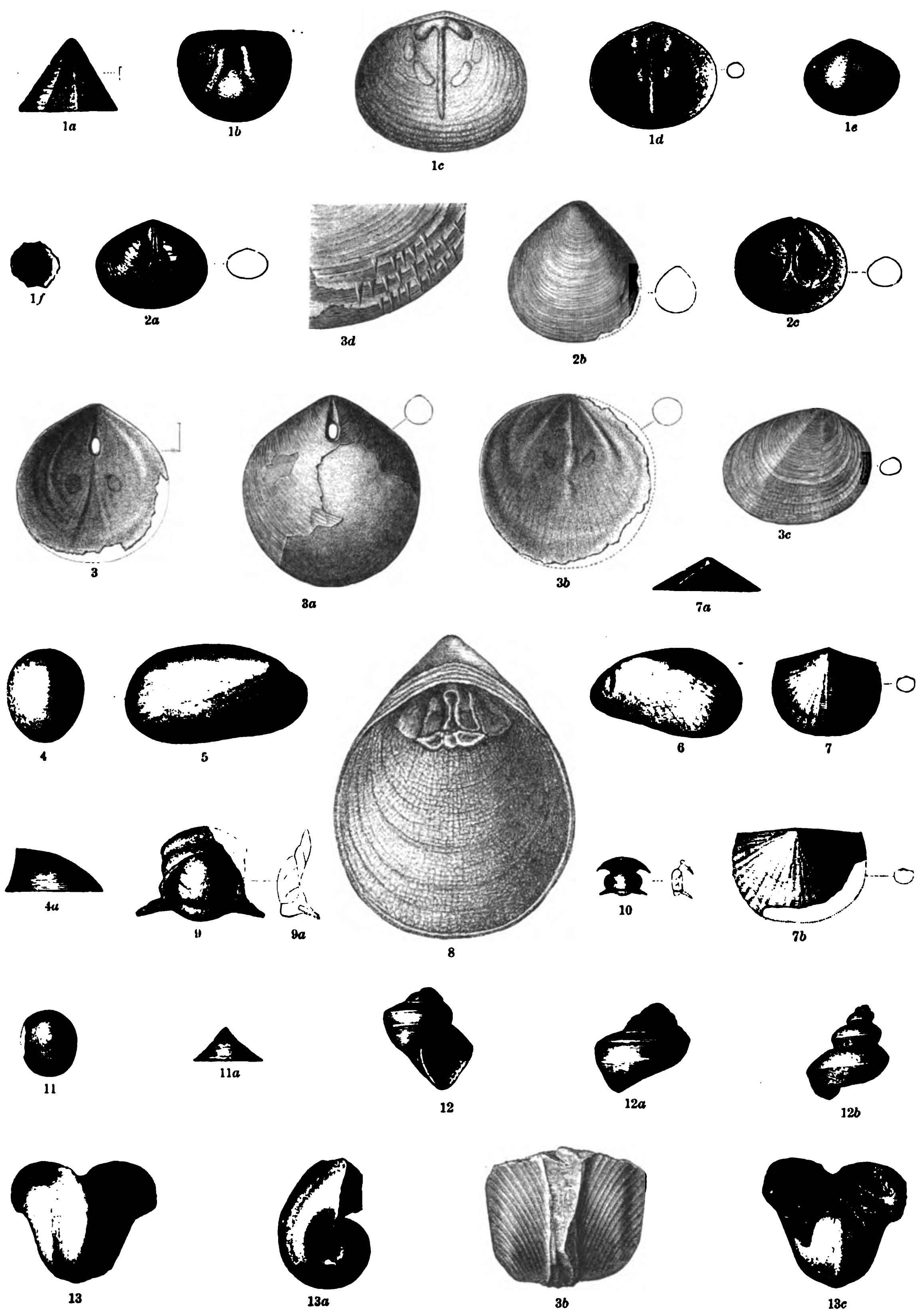
Figs. 11, 11*a*. Summit and side view of the type specimen. Natural size.

MURCHISONIA MILLERI 271

Figs. 12, 12*a*. Front and back view of the same specimen. Natural size.
12*b*. View of a cast. Natural size.

BUCANIA BIDORSATA 271

Figs. 13, 13*a*, 13*c*. Back, lateral, and front view of a specimen denuded of most of the shell. Natural size.
13*b*. Enlargement of the surface of another shell, that shows the characteristic surface lines.



CAMBRIAN AND SILURIAN

PLATE II.

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LINGULA ALBA-PINENSIS 108

Fig. 1. Broad form, enlarged to six diameters.
1*a*. Elongate form, enlarged to six diameters.

LINGULA LIGEA 107

Fig. 2. A typical specimen, enlarged to two diameters.

LINGULA LIGEA, var., NEVADENSIS 107

Fig. 3. Specimen showing the more attenuate form, as compared with fig. 2. Enlarged to two diameters.

LINGULA MELIE 274

Fig. 4. A distorted specimen. Natural size.

DISCINA LODENSIS 112

Fig. 5. Ventral valve. Natural size.
5*a*. Dorsal valve. Natural size.

PHOLIDOPS BELLULA 113

Fig. 6. Ventral valve, enlarged to six diameters.
6*a*. Cast of interior of ventral valve, enlarged to six diameters.
6*b*. Interior of ventral valve, enlarged to six diameters.

PHOLIDOPS QUADRANGULARIS 114

Fig. 7. Enlargement to three diameters of the type specimen.

CHONETES DEFLECTA 124

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STROPHODONTA DEMISSA 118

Figs. 9, 9*a*, 9*b*. Lateral, ventral, and dorsal views of a specimen from Lone Mountain.

PRODUCTUS HIRSUTIFORME 133

Fig. 10. Enlargement to three diameters of a small ventral valve, preserving three of the slender surface spines.
10*a*. A large ventral valve, showing a portion of the outer shell and cast of the inner surface.

STROPHODONTA INEQUIRADIATA 120

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11*a*. Enlargement of the surface of fig. 11.

ORTHIS TULLIENSIS 115

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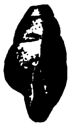
CHONETES MACROSTRIATA 126

Fig. 13. Dorsal view. Natural size. See plate xiii, figs. 14, 14*a–c*.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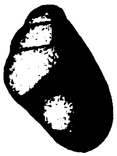
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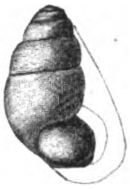
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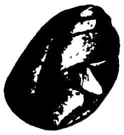
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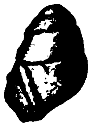
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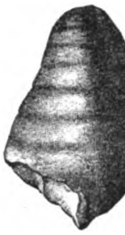
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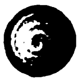
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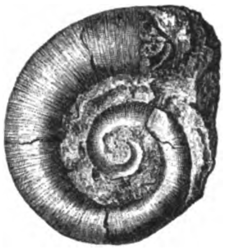
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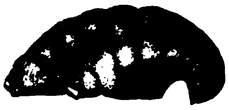
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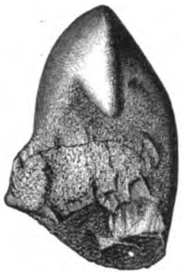
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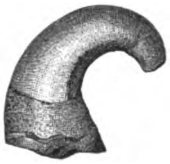
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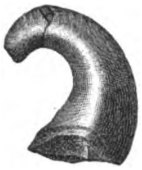
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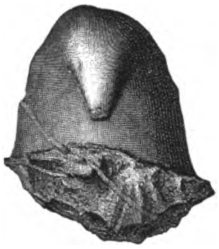
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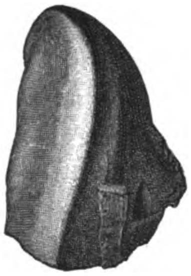
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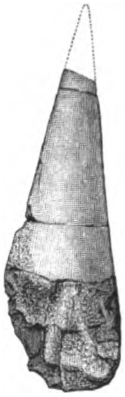
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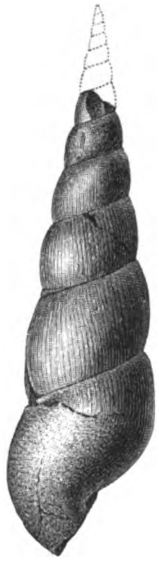
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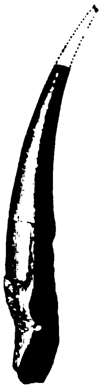
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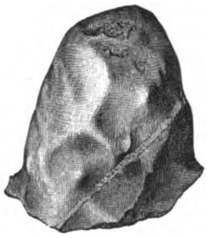
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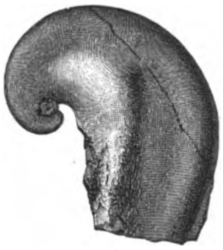
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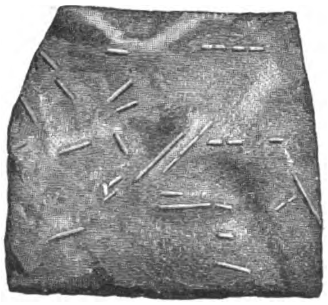
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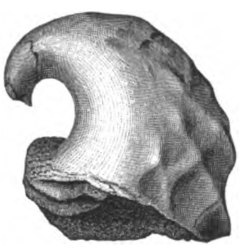

5*b*

DEVONIAN

PLATE VII.

Page.

Discina Newberryi 213

Fig. 1. Lateral view of the specimen figured on plate xviii, fig. 3.

Productus subaculeatus 214

Fig. 2. Ventral valve. Natural size. See plate xiii, figs. 19, 20.

Discina connata 214

Fig. 3. Ventral valve. Natural size.
3 *a*. Side view of fig. 3.

Discina nitida 213

Figs. 4, 4 *a*. Interior of compressed ventral valves, showing the smooth inner surface and rougher outer surface marked by strong concentric striæ.

Retzia radialis 220

(A series to illustrate the variation in the number and size of the radiating surface plications, all enlarged to two diameters.)

Figs. 5, 5 *a*. *Retzia Verneuiliana* Hall, a specimen from the Lower Carboniferous of the Little Belt Mountains, near Clendenin, Montana.
5 *b*. From the Devonian White Pine shale.
5 *c*, *d*, *e*. Lower Carboniferous forms from the Eureka District.
5 *f*, *g*, *h*. Upper Carboniferous forms from the Eureka District.

Rhynchonella Thera 223

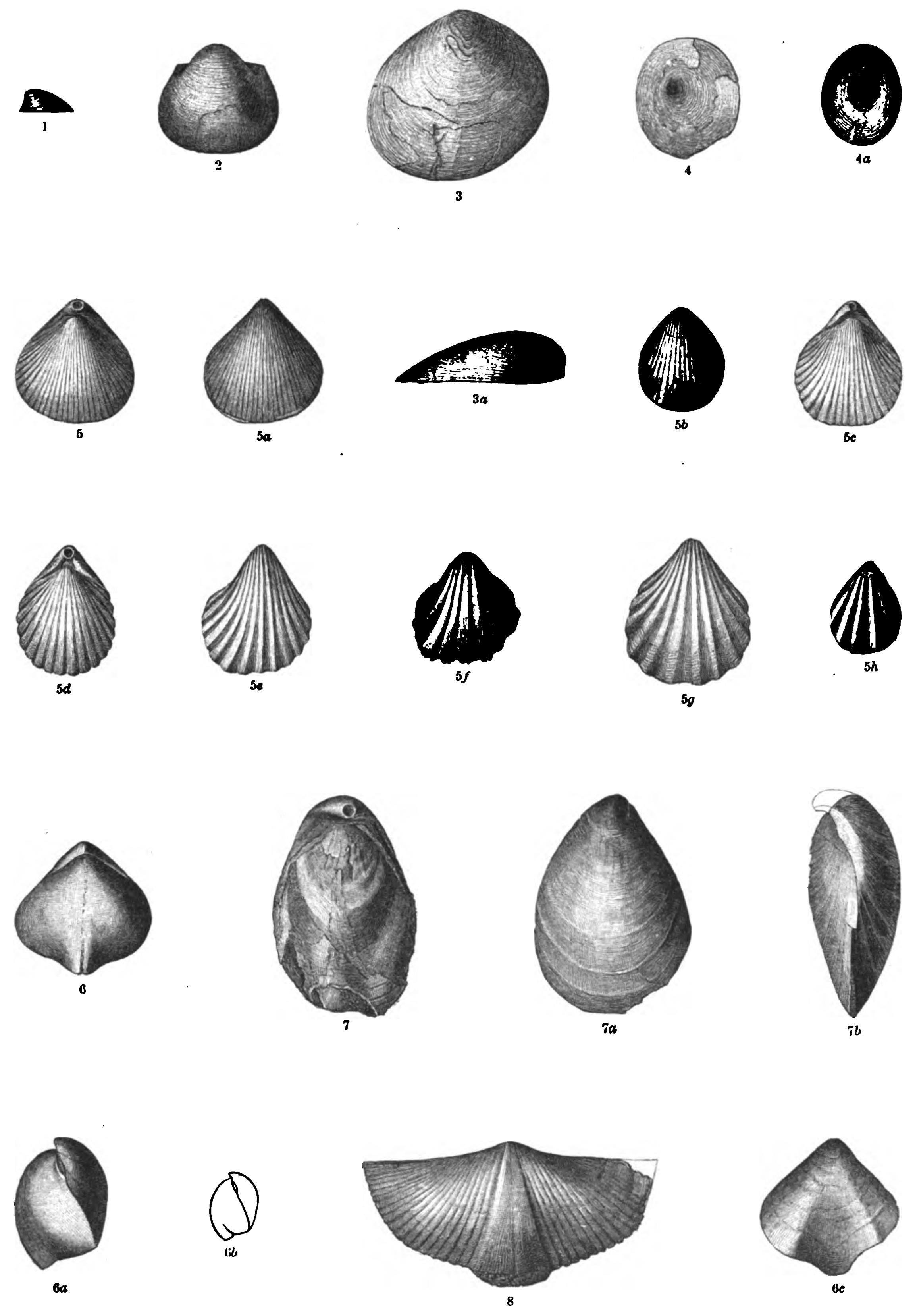
Figs. 6, 6 *a*, *b*, *c*. Dorsal, lateral, and ventral views of a typical specimen, enlarged to two diameters.

Terebratula hastata 224

Figs. 7, 7 *a*. Dorsal and ventral views of a somewhat crushed specimen. Natural size.
7 *b*. Lateral view of a more perfect shell. Natural size.

Spirifera desiderata 217

Fig. 8. Dorsal valve. Natural size.



CARBONIFEROUS

PLATE VIII.

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Pterinopecten Spio 233

Fig. 1. Left valve, in which the surface has been largely removed, leaving the radiating costæ and concentric lines in strong relief. Natural size.
1*a*. Left valve, on which the concentric lines are faintly defined. Natural size.

Macrodon truncatus 243

Fig. 2. Left valve, enlarged to nearly three diameters.

Pleurophorus Meeki 246

Fig. 3. Cast of left valve. Natural size.

Streblopteria similis 230

Fig. 4, 4*b*. Right valves. Natural size.
4*a*, 4*c*. Left valves. Natural size.
4*d*. Finely striated left valve. See plate xix, fig. 7.

Ptychopteria protoforme 235

Fig. 5. Left valve. Natural size.

Aviculopecten Pintöensis 228

Fig. 6. Left valve. Natural size.

Crenipecten Hallanus 231

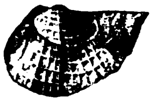
Fig. 7. Cast of a large right valve. Natural size.
7*a*. A small right valve.
7*b*. A large left valve. Natural size.
7*c*. Enlargement of the surface to show fine concentric striæ crossing the radiating plications.

Aviculopecten peroccidens 227

Fig. 8. Left valve. Natural size.

Pterinopecten Hoosacensis 232

Fig. 9. Left valve. Natural size.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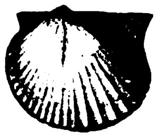
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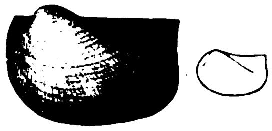
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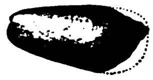
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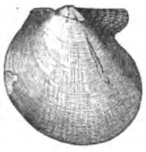
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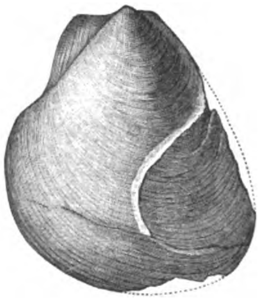
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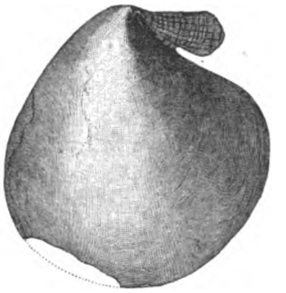
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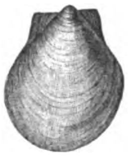
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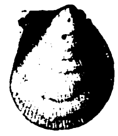
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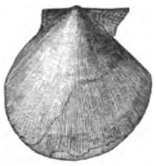
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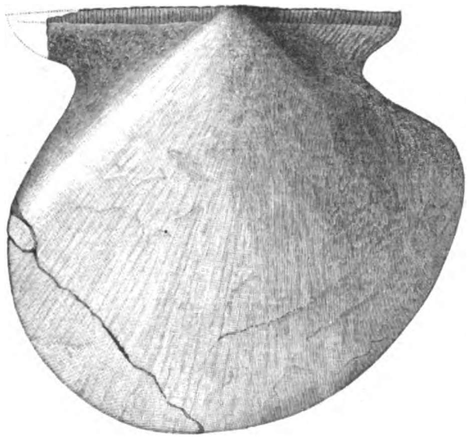
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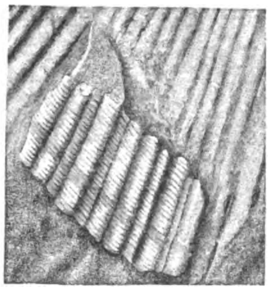
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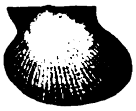
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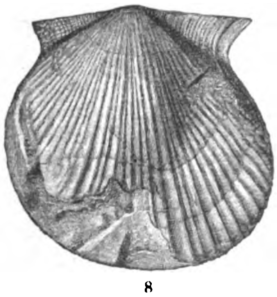
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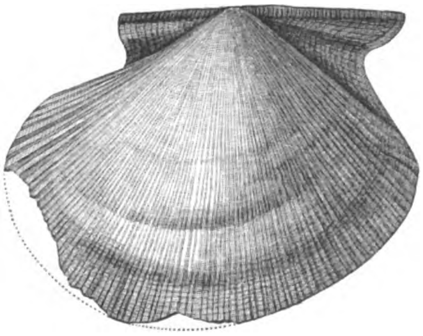
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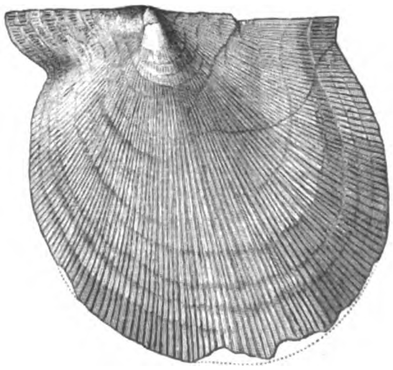
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CARBONIFEROUS

PLATE IX.

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Kutorgina Prospectensis 19

Fig. 1. Dorsal valve, enlarged to three diameters.
1*a*. Ventral valve equally enlarged.
1*b*. Restored outline of the two valves united.

Stenotheca elongata 23

Fig. 2. Upper side, enlarged to three diameters.
2*a*. Lateral view of the same specimen.

Lingula ? manticula 13

Fig. 3. Ventral valve, showing the more ovate form. See plate xi, fig. 2.

Kutorgina Whitfieldi 18

Fig. 4. Ventral valve, with outline restored, enlarged to two diameters.
4*a*. Dorsal valve, with outline of convexity below. Natural size.

Protospongia fenestrata Salter ? 11

Figs. 5, 5 *a*, *b*. Three forms of spiculæ; 5*b* is the more unusual form. Natural size.

Scenella ? conica 15

Fig. 6. Posterior view, showing the elevation; the slight groove is very much too strong, it is scarcely descernible on the specimen.

Kutorgina sculptilis 20

Fig. 7. Dorsal valve, enlarged to six diameters. See plate i, figs. 7. 7 *a*, *b*.

Orthis Eurekensis 22

Fig. 8. Dorsal valve, enlarged to three diameters.
8*a*. Ventral valve, similarly enlarged and showing the cast of the muscular scars.

Acrotreta gemma 17

Fig. 9. Lateral view, enlarged to four diameters.
9*a*. View from above of the same. See plate i, figs. 1 *a–e*.

Agnostus Richmondensis 24

Fig. 10. View of the cephalic shield, enlarged to four diameters.

Acrothele ? dichotoma 14

Fig. 11. View of the specimen described, enlarged to three diameters.

Olenellus Iddingsi 28

Fig. 12. View of the type specimen, enlarged to two diameters.

Agnostus bidens 26

Fig. 13. Cephalic shield, enlarged to four diameters.
13*a*. Small caudal shield associated with the above, enlarged to five diameters.

Agnostus seclusus 25

Fig. 14. Cephalic shield, enlarged to four diameters.

PLATE IX—Continued.

Page.

Olenellus Howelli 30

Fig. 15. View of a specimen fully developed, excepting the presence of an ocular ridge, and the distance of the eyes from the glabella. The genal spines are too short in the figure. Natural size.

15 *a*. Natural-size view of a head having the genal angles carried forward; eyes without an ocular ridge, and the angles of the posterior margin strongly marked.

15 *b*. The head of a young individual, enlarged to four diameters, in which the embryonic features are still more prominent. See plate xxi, figs. 1-9.

15 *c*. Fragments of thoracic segments associated with this and the following species.

Olenellus Gilberti 29

Fig. 16. View of a large head, Natural size. See plate xxi, fig. 13.

16 *a*. Fragment showing the glabella and a portion of the palpebral lobes. Natural size.

Anomocare ? parvum 59

Fig. 17. Enlargement of the specimen described to five diameters. The outline of the postero-lateral limb probably extends laterally a little more than in the figure.

Ptychoparia (?) Linnarssoni 47

Fig. 18. View of the broad form of the head, exclusive of the free cheeks, × 2.

18 *a*. View of the narrow form, similarly enlarged.

Dicellocephalus ? expansus 45

Fig. 19. View showing the character of the glabella and the peculiar ridges crossing the anterior portion of the fixed cheeks, enlarged to one and one-half diameters.

Ptychoparia (?) Prospectensis 46

Fig. 20. View of the type specimen, enlarged to three diameters. The furrow crossing the glabella at the second pair of glabellar furrows is not seen in the specimen.

Ptychoparia (Pterocephalus ?) occidens 58

Fig. 21. The test is largely exfoliated from the surface of the glabella, and but one pair of furrows are shown; figure enlarged to three diameters.

Ogygia ? ? spinosa 63

Fig. 22. View showing the central portions of the head. Natural size.

Agraulos globosus 61

Fig. 23. A minute, very convex head, enlarged to four diameters.

Dicellocephalus ? quadriceps 45

Fig. 24. Small head, enlarged to three diameters.

Dicellocephalus Osceola 40

Fig. 25. View of specimen identified with the Wisconsin species. Natural size.

Ptychoparia Anytus 56

Fig. 26. Central portions of the head, enlarged three diameters. The fixed cheeks are more elevated at the outer termination of the ocular ridges than represented.

Arethusina Americana 62

Fig. 27. View of central portions of head; the ocular ridges are stronger than in the figure; enlarged to three diameters.

Ptychoparia (E.) dissimilis 51

Fig. 28. View of fragment showing the central portion of the head. Natural size.

Cambrian

PROSPECT MOUNTAIN GROUP.

U. S. Geological Survey. Geology of Eureka District, Plate IX

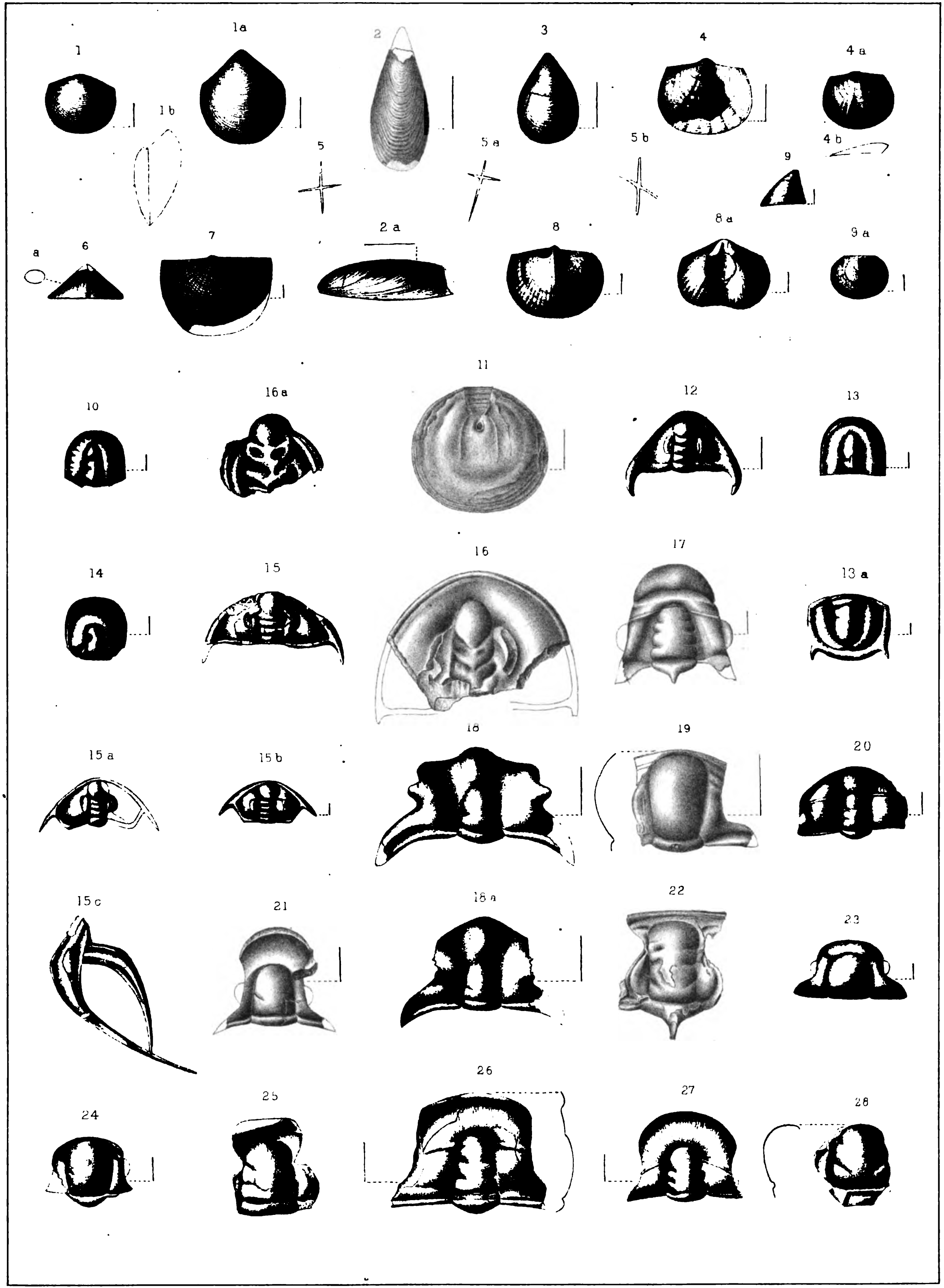

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PLATE X.

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DICELLOCEPHALUS ? ANGUSTIFRONS 49

Fig. 1. View of the movable cheek associated with the glabella.
1*a*. View of the glabella, palpebral lobes, and outline of the convexity of the glabella. Natural size.
1*b*. A pygidium occurring in the same hard specimen of rock. Natural size.

OGYGIA ? PROBLEMATICA 63

Fig. 2. Usual form of the head of the adult, with the facial sutures and outline of the convexity of the glabella. Natural size.
2*a*. Pygidium associated with the head and fragment of the thoracic pleura, represented by fig. 2*b*. See fig. 4.

PTYCHOPARIA OWENI 55

Fig. 3. Nearly complete head within the facial sutures, enlarged to two diameters.
3*a*. Pygidium associated with the same, similarly enlarged.

OGYGIA ? PROBLEMATICA 63

Fig. 4. Enlargement to four diameters of a small head, in which the movable cheeks are absent, the postero-lateral limbs are broken away, and the glabellar furrows obsolete. There are specimens intermediate to those represented by fig. 2 and fig. 4.

PTYCHOPARIA OCCIDENTALIS 51

Fig. 5. View natural size, showing the features of the glabella and fixed cheeks.

DICELLOCEPHALUS RICHMONDENSIS 41

Fig. 7. View of the central portions of the head, showing the broad frontal limb and fixed cheeks. Natural size.

PTYCHOPARIA ? PERNASUTUS 49

Fig. 8. Upper view of the head parts discovered. The nasute projection of the frontal border is a little short in the figure. Natural size.
8*a*. Movable cheek, associated with the preceding.
8*b*. Lateral view of the specimen from which fig. 8 was drawn.

PTYCHOPARIA (SOLENOPLEURA) BREVICEPS 49

Fig. 9. View of the type specimen to show the broad, short form of the head, and rounded conical glabella, enlarged to three diameters.

PTYCHOPARIA (?) SIMILIS 52

Fig. 10. Enlargement to two diameters of the central portions of the head, showing the character of the frontal limb and glabella.

PTYCHOPARIA 00

Fig. 11. Movable cheek, associated with *Ptychoparia unisulcatus.*

PTYCHOPARIA (E.) AFFINIS 54

Fig. 12. View of specimen, showing the narrow frontal limb, as compared with fig. 10, and the strongly-marked glabellar furrows, enlarged to two diameters.

PLATE X—Continued.

Page.

Dicellocephalus Marica 44

Fig. 13. Enlargement to three diameters of the central portions of the head.
Fig. 14. Free cheek, associated with figs. 2 and 3.

Dicellocephalus nasutus 40

Fig. 15. Central portion of the head, showing the glabella and prolonged anterior border of the head. Natural size.

Chariocephalus ? tumifrons 61

Fig. 16. Specimen showing the frontal margin, and a less protuberant frontal lobe to the glabella than in the type of the species, enlarged to two diameters.
Fig. 6. Pygidium associated with *Chariocephalus tumifrons*, and supposed to belong to the species.

Ptychoparia læviceps 54

Fig. 17. View of the central portions of the head, enlarged to three diameters, with the postero-lateral limbs broken off.
18. Free cheek, associated with the heads of this species and *P. Oweni*.

Dicellocephalus Iole 43

Fig. 19. View showing the strongly-marked features of the central portion of the head of the species, enlarged to two diameters.
Fig. 20. Hypostoma, associated with fragments of a species of the genus Dicellocephalus, enlarged to three diameters.

Ptychoparia 00

Fig. 21. Strongly convex hypostoma, associated with *Ptychoparia Oweni*, enlarged to three diameters.
Fig. 22. An hypostoma, similarly enlarged, associated with *Ptychoparia anytus*, *P. Oweni*, and *P. læviceps*.

Ptychaspis minuta 60

Fig. 23. Enlargement to four diameters of a head, showing the glabella, fixed cheeks, ocular ridges, and depressed frontal limb.

Cambrian

PROSPECT MOUNTAIN GROUP.

U. S. Geological Survey. Geology of Eureka District, Plate X.

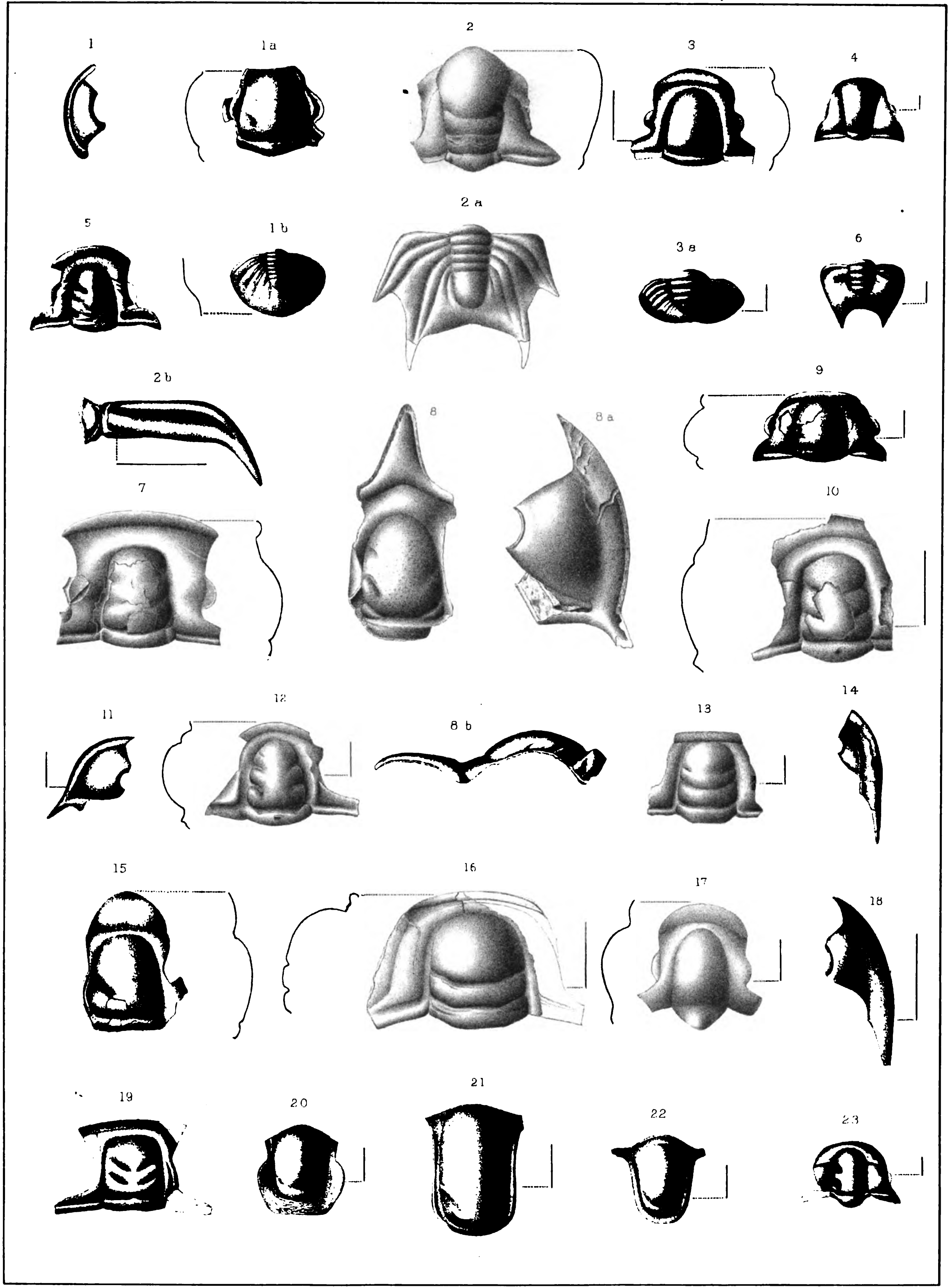

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PLATE XI.

Page.

Tellinomya ? Hamburgensis 76

Fig. 1. Left valve, enlarged to two diameters, to show the fine surface striæ.
1*a*. Same valve, showing the posterior margin more depressed, which is the usual form of the species, enlarged to two diameters.

Lingula ? manticula 13

Fig. 2. A specimen of the broad variety of the species, from which the outer surface is exfoliated, enlarged to two diameters. See plate ix, fig. 3.

Orthis perveta 72

Figs. 3, 3*a*, 3*b*. Dorsal, ventral, and lateral views of a characteristic specimen, enlarged to two diameters.

Orthis tricenaria 74

Figs. 4, 4*a*. Ventral and dorsal views, showing the strong radiating costæ and form of the valves, enlarged to two diameters.

Orthis Hamburgensis 73

Fig. 5. Ventral valve, enlarged to three diameters to show the fissicostate plications and general form of the valve.
5*a*. Same, of the dorsal valve.

Orthis Lonensis 74

Fig. 6 Ventral view and outline of the convexity of the ventral valve. Natural size.
6*a*. View of the area, showing the triangular-shaped foramen.

Triplesia calcifera 75

Fig. 7. Ventral valve, enlarged to two diameters.
8. Ventral valve of this or an allied species. The valve is convex and the median fold rounded.

Streptorhynchus minor 75

Fig. 9. Ventral valve, enlarged to two diameters.

Orthis testudinaria 72

Fig. 10. Ventral valve. The cardinal angles are more rounded in the specimen.
10*a*. Dorsal valve a little enlarged.

Receptaculites mammillaris 65

Fig. 11. View looking on the base of a small specimen.

Receptaculites ellipticus 67

Fig. 12. Lateral view.

Modiolopsis Pogonipensis 78

Fig. 13. View of the left valve enlarged to two diameters. See plate i, fig. 6.

Modiolopsis occidens 77

Fig. 14. Outline of a large right valve, as seen on a weathered surface of rock.
14*a*. Smaller right valve, showing the exterior form. Natural size. See plate i, fig. 5.

PLATE XI—Continued.

Page.

Tellinomya contracta ? 76

Fig. 15. Left valve, enlarged to two diameters.
15 *a*. Interior of a smaller specimen.

Hyolithes Vanuxemi 85

Figs. 16, 16 *a*. Views of the ventral and dorsal sides, enlarged to two diameters.
16 *b*. Transverse section of the tube.

Coleoprion minuta 85

Figs. 17, 17 *a*. Lateral views of a straight and slightly curved tube, enlarged to four diameters. See plate xii, fig. 21.

Maclurea subannulata 82

Fig. 18. View of the upper side, showing the depressed character of the spire and the annulations on the cast of the outer whorl.
18 *a*. View of the lower side of the same specimen.
18 *b*. Section of the outer whorl.

Maclurea annulata 81

Fig. 19. View of the lower side, showing the annulations of the outer surface of the shell, enlarged to two diameters.
19 *a*. Internal cast of the lower side, similarly enlarged.

Maclurea carinata 82

Fig. 20. View of the lower side, showing the strong surface striæ.
20 *a*. Cast of the lower side.

Raphistoma Nasoni 78

Figs. 21, 21 *a*. Lateral and summit view of small specimen.

Pleurotomaria Lonensis 80

Fig. 22. Lateral view of the specimen from Lone Mountain. Natural size.

Silurian

POGONIP GROUP.

U. S. Geological Survey. Geology of Eureka District, Plate XI

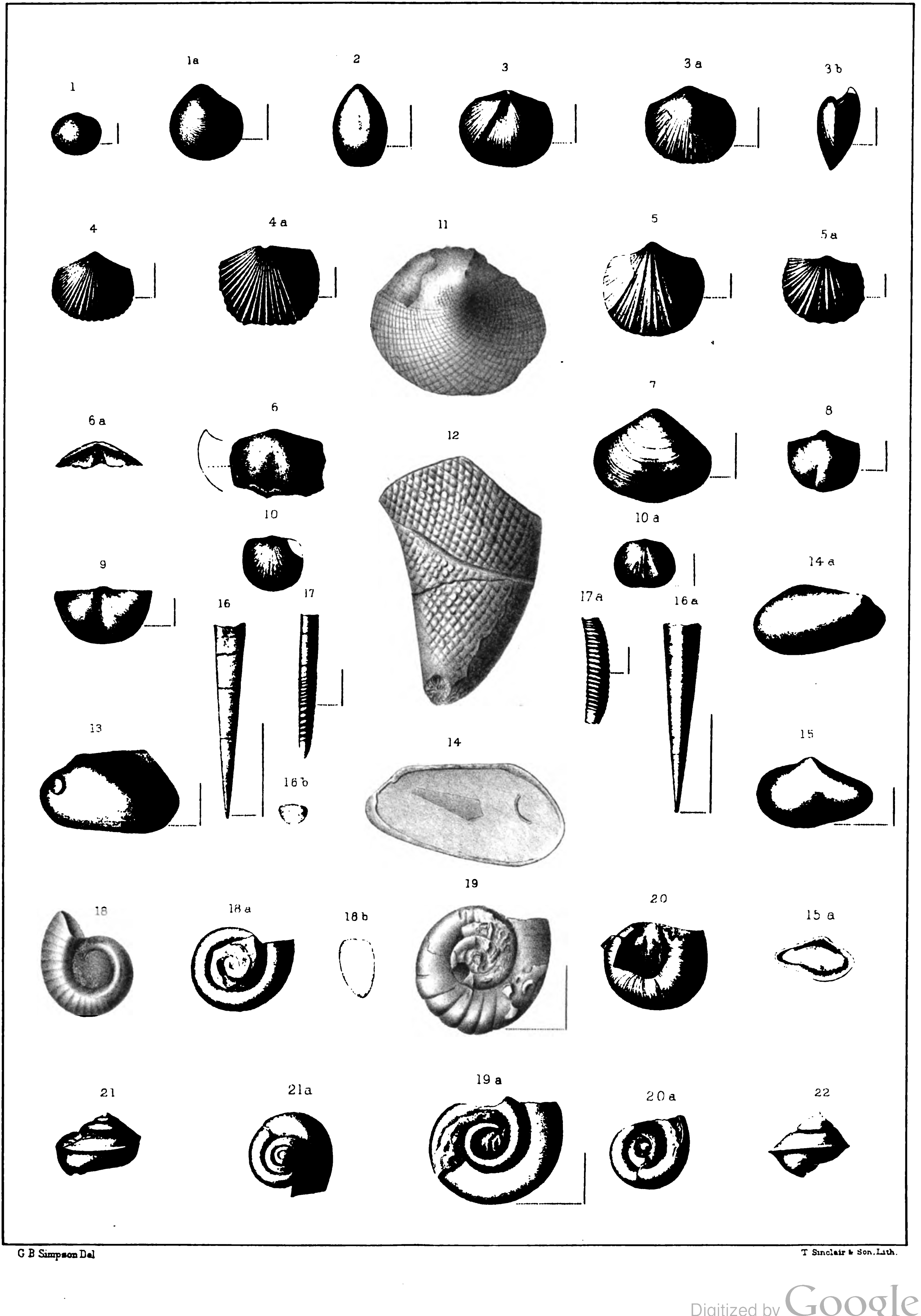

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PLATE XII.

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ENDOCERAS PROTEIFORME 86

Fig. 1. View of siphuncle with included tube.
  1 *a*. Cross-section of another specimen.
  1 *c*. Opposite side of upper portion of fig. 1, showing annulated shell of the siphuncle.

ORTHOCERAS, sp.? 87

Fig. 1 *b*. Oblique, transverse section. The outer shell is restored and is too small, and it is also less circular in outline. The fragment crossing the siphuncle is of accidental origin.

ORTHOCERAS, sp.? 86

Fig. 2. A portion of the shell, preserving a number of the septa and a portion of the siphuncle.

ORTHOCERAS MULTICAMERATUM? 86

Fig. 3. Fragment showing the form of the tube, the septa, and a portion of the siphuncle.

ILLÆNURUS EUREKENSIS 97

Fig. 4. View of the central portion of the head and outline of the convexity of the same, enlarged to two diameters.
  4 *a*. Associated free cheek.

BARRANDIA? MCCOYI 96

Fig. 5. View of the glabella and fixed cheeks, and a longitudinal outline of the convexity of the head, enlarged to two diameters.

BARRANDIA? sp.? 96

Fig. 6. View of the glabella. Natural size.

ASAPHUS CARIBOUENSIS 98

Fig. 7. View of the head within the facial sutures, also outline of longitudinal section.
  7 *a*. An associated free cheek.
  7 *b*. Pygidium found in the same association.

BATHYURUS? CONGENERIS 92

Fig. 8. View of glabella and fixed cheeks, enlarged to two diameters.
  8 *a*. Pygidium associated in the same layer of rock.

BATHYURUS TUBERCULATUS 91

Fig. 9. View of the glabella and a portion of the fixed cheeks, enlarged to two diameters.

CYPHASPIS? BREVIMARGINATA 93

Fig. 10. Enlargement to three diameters of the only specimen discovered.

BATHYURUS? SIMILLIMUS 93

Fig. 11. Enlargement to three diameters, to show the character of the glabella and frontal margin.

PLATE XII—Continued.

Page

DICELLOCEPHALUS FINALIS 89

Fig. 12. View of the central portions of the head. Natural size.
12*a*. Associated pygidium, enlarged to two diameters.
22. Portion of a thoracic segment on the same fragment of rock.

AMPHION NEVADENSIS 94

Fig. 13. View of the portions of the head preserved in the type specime. Natural size.
14. Pygidium of unknown generic and specific relations, occurring in association with *Asaphus Caribouensis*, enlarged to three diameters.

ASAPHUS ? CURIOSUS ? 98

Fig. 15. Pygidium associated with *Asaphus Caribouensis*, enlarged to two diameters.

SYMPHYSURUS ? GOLDFUSSI 95

Fig. 16. View of the glabella and portions of the fixed cheeks, enlarged to two diameters.

CERAURUS ? 95

Fig. 17. Glabella enlarged to three diameters, to show the granulose surface.

PTYCHOPARIA (?) ANNECTANS 91

Fig. 18. Glabella and fixed cheeks, enlarged to two diameters.

AMPYX ? 00

Fig. 19. Pygidium associated with the preceding, and also figs. 7 and 12, enlarged to two diameters.

ASAPHUS 00

Fig. 20. Strongly convex pygidium, associated with *Asaphus Caribouensis*.

COLEOPRION MINUTA 85

Fig. 21. Enlargement of a portion of the tube to four diameters, to show the arching of the striæ over the longitudinal ridge on the side opposite the arc of curvature. See plate xi, figs. 17, 17*a*.

Silurian

POGONIP GROUP.

U. S. Geological Survey. Geology of Eureka District, Plate XII.

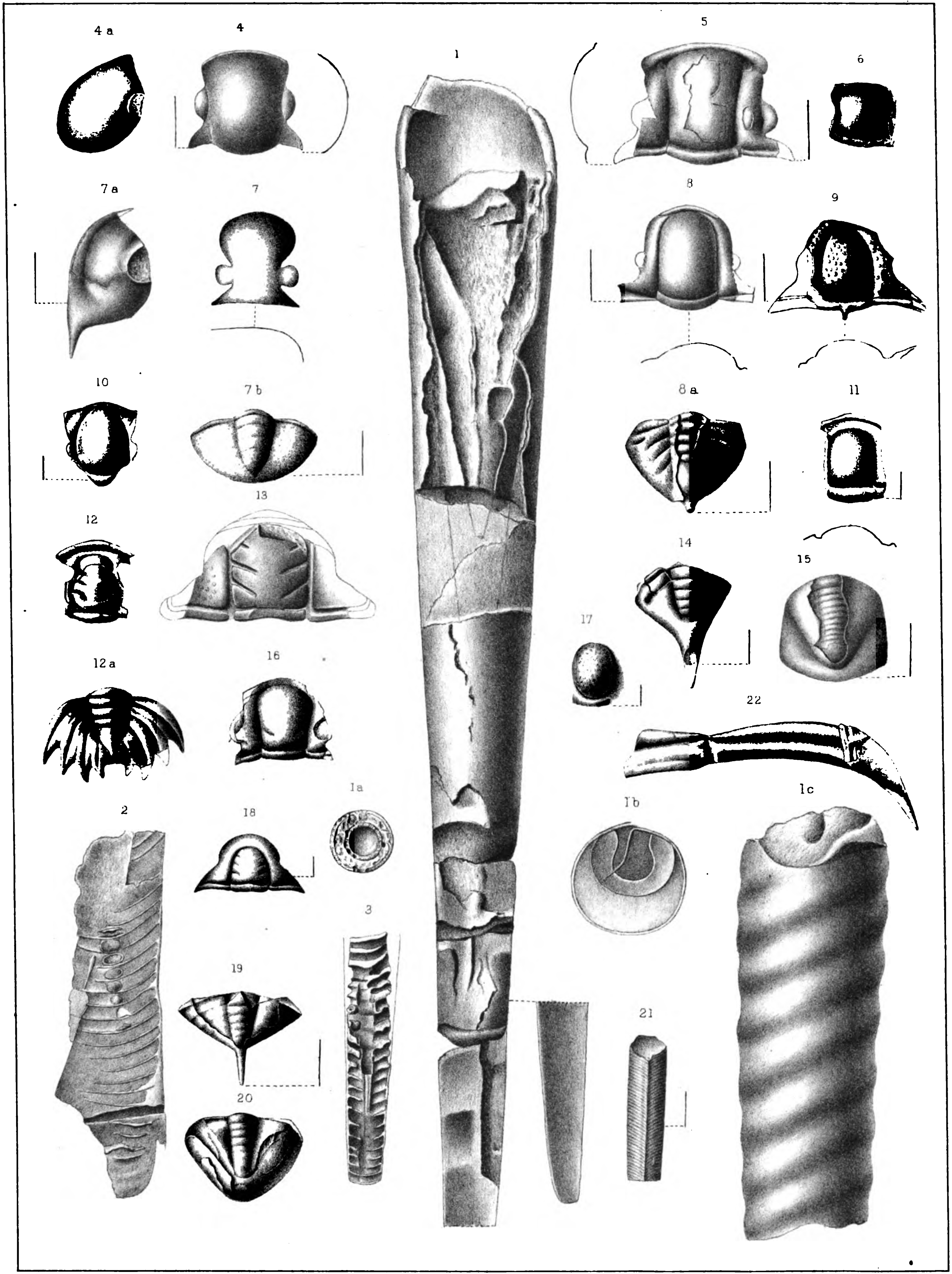

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PLATE XIII.

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LINGULA LONENSIS 108

Fig. 1. Ventral ? valve.
1*a*. Dorsal ? valve. Natural size.

LINGULA LÆNA 106

Fig. 2. Ventral valve, from which the surface is largely exfoliated. Natural size.

LINGULA WHITEI 109

Fig. 3. Cast of the interior of the dorsal valve, enlarged to two diameters.
d. Divaricator muscular scar.
a d. Adjustor muscular scars.
p a. Posterior adductor scar.
a a. Anterior adductor scar.
p p. Supposed area of attachment of the posterior parietal muscle.
u u. Supposed area of attachment of the walls of the perivisceral cavity.
p s. Great pallial sinus.
l s. Lateral branches of the great sinus.
i. Area, that in another specimen shows the inner ramifications of the great sinus.
The various features are rather strongly shown in the figure, but not more so than is justified by the original specimen.

SKENIDIUM DEVONICUM 116

Fig. 4. Ventral valve, enlarged to three diameters.
4*a*. Cardinal view, showing the areas of the two valves, the foramen, and the medium septum of the dorsal valve.

DISCINA MINUTA 112

Fig. 5. View of a rather elongate dorsal valve, enlarged to two diameters.

STROPHODONTA CALVINI 122

Fig. 6. View of ventral valve. Natural size.

STREPTORHYNCHUS CHEMUNGENSIS 117

Fig. 7. View of a specimen referred to the variety *arctostriata*. Natural size.
16. View of a specimen corresponding to the typical forms of the species. Natural size.

PRODUCTUS SPECIOSUS 133

Fig. 8. View showing the surface ornamentation and form of the ventral valve. Natural size.

PRODUCTUS NAVICELLUS 131

Fig. 9. Lateral view of a somewhat strongly costate variety, enlarged to two diameters.

STROPHODONTA PUNCTULIFERA 121

Fig. 10. View of ventral valve, showing radiating striæ and punctate surface. Natural size.

STROPHODONTA PERPLANA 120

Fig. 11. View of a well-preserved ventral valve, with a portion of the outer surface exfoliated.

PLATE XIII—Continued.

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Palæomanon Roemeri 99

Fig. 12. View showing the cup-shaped summit and general form. Owing to silicification, the details of the structure are destroyed.

Orthis impressa 115

Fig. 13. Cast of ventral valve. Natural size.

Chonetes macrostriata 126

Fig. 14. Ventral view and outline of the convexity of an average size specimen.

14 *a*. Same view of an unusually large specimen from which the striated outer surface has been removed, showing the inner punctate surface.

14 *b*. View of ventral valve of a small, strongly-marked specimen, to which a cardinal spine is attached; 14, 14 *a*, *b* are natural size.

14 *c*. Enlargement of the striæ of fig. 14, to show manner of bifurcation. See plate ii, fig. 13.

Chonetes filistriata 127

Fig. 15. Ventral view of average size specimen, showing surface striæ and cardinal spines.

15 *a*. Enlargement of the area of the ventral valve, showing the shape of the foramen.

Productus Hallanus 130

Fig. 17, 17 *a*. Dorsal and ventral view of average size specimens.

Productus lachrymosus, var. Limus 132

Figs. 18, 18 *a*. Lateral and front view of the ventral valve.

Productus subaculeatus 128

Figs. 19, 19 *a*. Ventral and cardinal views of a specimen from which the outer shell is partially exfoliated.

20, 20 *a*. Same view of the type of the species copied from plate ii, tome xi, Bull, Soc. Geol. de France. The spine bases are stronger than in 19, 19 *a*, but in other specimens they are much as in figs. 20, 20 *a*. See plate vii, fig. 2.

Devonian

U. S. Geological Survey.

Geology of Eureka District, Plate XIII.

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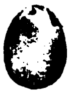

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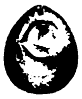

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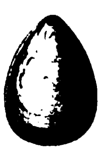

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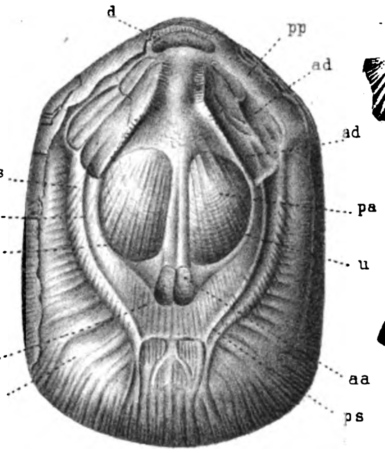

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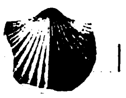

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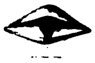

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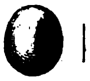

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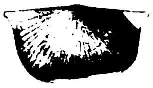

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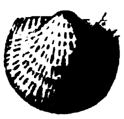

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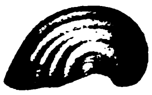

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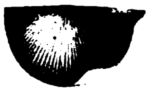

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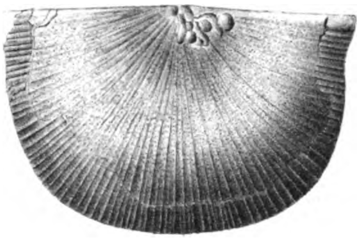

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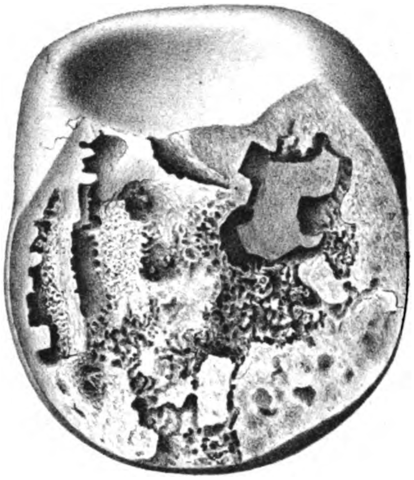

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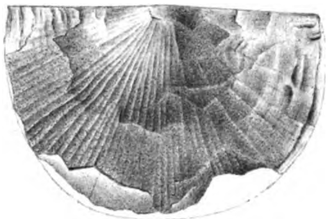

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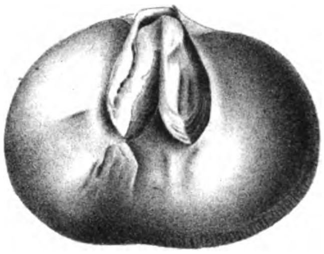

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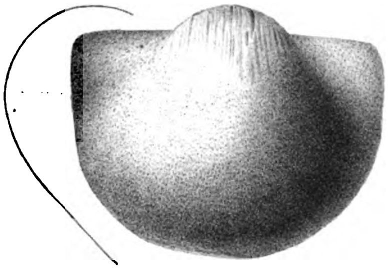

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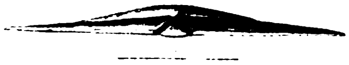

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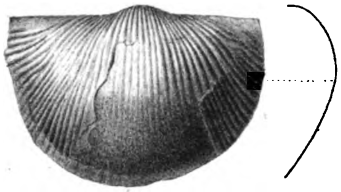

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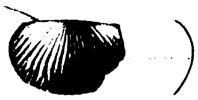

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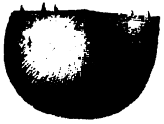

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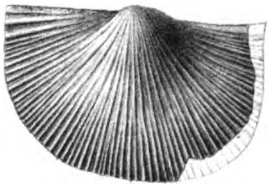

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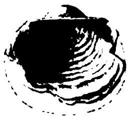

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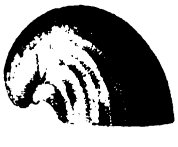

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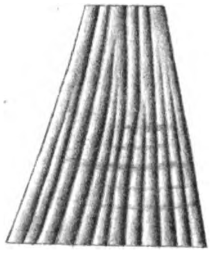

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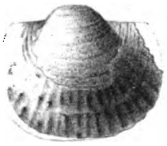

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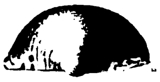

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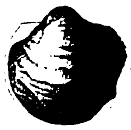

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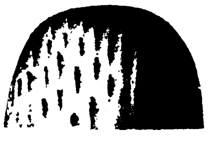

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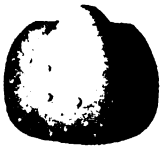

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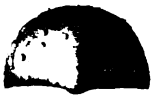

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PLATE XIV.

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Productus Shumardianus 129

Fig. 1. View of the dorsal valve. Natural size.

Productus truncatus 131

Fig. 2. View to show the truncated apex of the ventral valve. Natural size.

Rhynchonella Horsfordi 152

Fig. 3. Ventral view of an average size specimen. See plate xv, fig. 6.

Atrypa desquamata 150

Fig. 4. View of the ventral valve.
4 *a*. Cardinal view to show the small area. Natural size.

Rhynchonella (L.) sinuata 158

Fig. 5. Dorsal view of a characteristic specimen. Natural size.

Atrypa reticularis 150

Figs. 6, 6 *a*, 6 *b*. Ventral, lateral, and dorsal views of the small variety mentioned in the text as characteristic of the Niagara formation.

Rhynchonella pugnus 155

Figs. 7, 7 *a*. Lateral and ventral views of an average size specimen.

Rhynchonella duplicata 155

Fig. 8. Dorsal view of a very striking example of the species.

Rhynchonella (L.) Nevadensis 157

Figs. 9, 9 *a*, 9 *b*. Ventral, lateral, and dorsal views of the ordinary type of the species.

Spirifera Parryana 137

Fig. 10. Ventral view of the only specimen obtained, showing the costæ and fine radiating striæ.

Spirifera (M.) undifera 143

Figs. 11, 11 *a*, *b*. Dorsal, lateral, and ventral views of a specimen from which most of the outer surface is removed.
13 *b*. Ventral valve with a portion broken away, showing the cast of the muscular impression.
13 *c*. Ventral valve of a broad variety of the species, showing the area and small deltidium in place. See plate iii, figs. 3, 3 *a*, *b*, 6, 6 *a*.

Spirifera (M.) raricosta 135

Fig. 12. View of the partial cast of the dorsal valve of a small shell. See plate iv, figs. 2, 2 *a*.

Spirifera (M.) Maia 141

Figs. 13, 13 *a*. Dorsal and lateral views of an average specimen of the species. See plate iii, figs. 1, 1 *a*–*e*.

Spirifera (M.) glabra, var. Nevadensis 139

Figs. 14, 14 *a*, *b*. Dorsal, lateral, and front views of the largest and most transverse specimen in the collection. See plate iii, fig. 5.

Pentamerus (M.) comis 159

Figs. 15, 5 *a*, *b*. Dorsal, lateral, and ventral views of a transverse, smooth specimen. See plate iii, figs. 4, 7, and plate xv, figs. 5, 5 *a*, *c*.

Devonian.

U. S. Geological Survey. Geology of Eureka District, Plate XIV

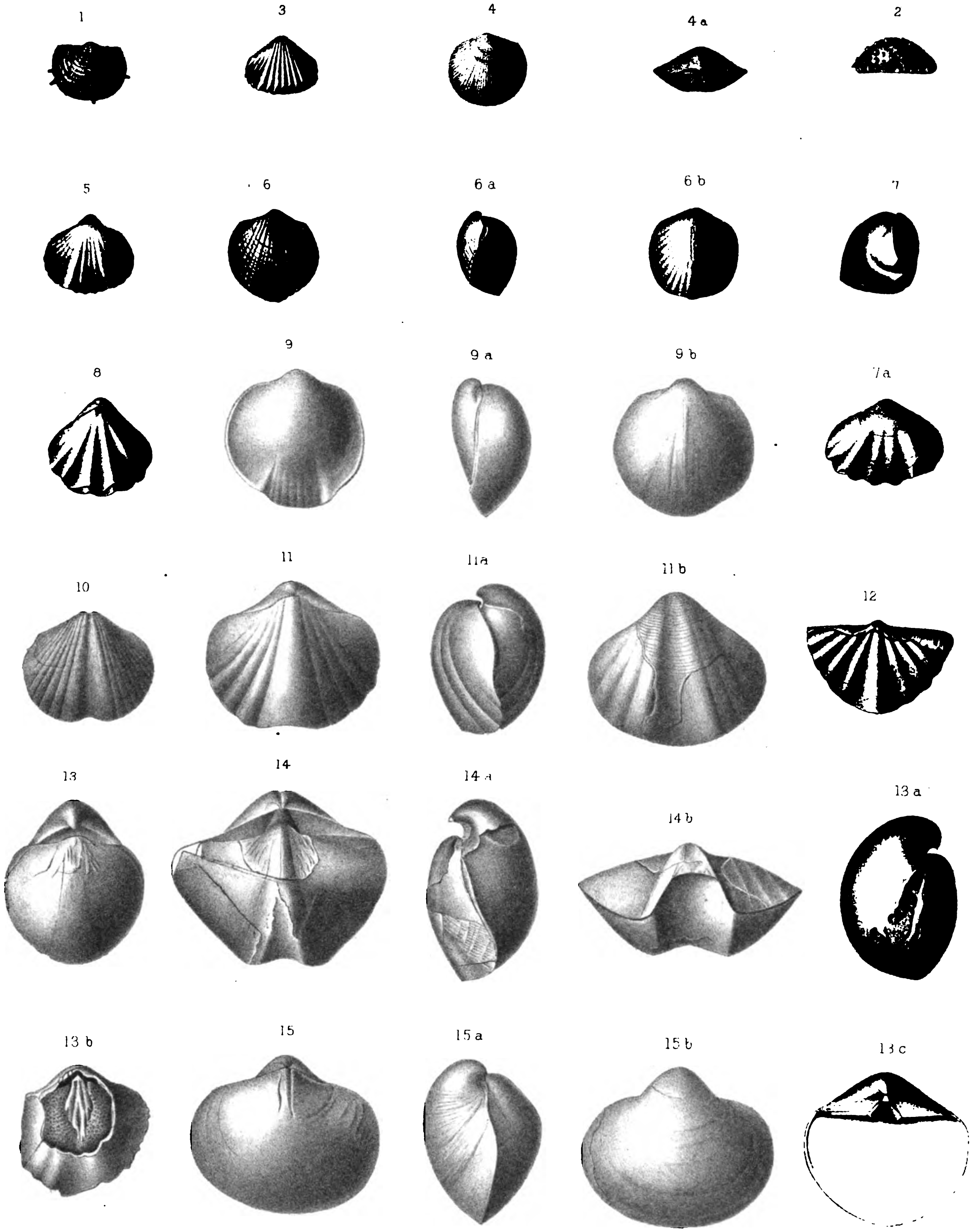

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PLATE XV.

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Rhynchonella castanea 153

Figs. 1, 1 *a*. Front and lateral views of a small subcuboidal specimen.
4, 4 *a*. Ventral and lateral view of an adult shell.

Cryptonella ? circula 163

Figs. 2, 2 *a*, *b*. Ventral, lateral, and dorsal views of a rather large specimen, enlarged to two diameters.

Rhynchonella ? occidens 152

Figs. 3, 3 *a*, *b*. Dorsal, ventral, and lateral views of a typical specimen, enlarged to two diameters.

Pentamerus comis 159

Figs. 5. Ventral view of a specimen, showing obscure plications towards the front.
5 *a*, 5 *b*. Lateral and ventral views of a rotund, smooth example. See plate iii, figs. 4 and 7, and plate xiv, figs. 15, 15 *a*, *b*.

Rhynchonella Horsfordi 152

Fig. 6. Dorsal view of a little smaller example than that shown by fig. 3, plate xiv.

Anadontopsis amygdalæformis 180

Fig. 7. Lateral view of the left valve.
7 *a*. Cardinal view of the two valves united.
7 *b*. Anterior view of the same.

Dystactella insularis 172

Fig. 8. Lateral view of the left valve, showing the anterior muscular scar.

Nucula Rescuensis 172

Fig. 9. View of left valve, enlarged to three diameters.

Goniophora perangulata 171

Fig. 10. View of left valve, showing the strongly-marked angular ridge.

Cypricardinia indenta 182

Fig. 11. Lateral view of left valve, enlarged to two diameters, to show the characteristic surface markings. See plate v, fig. 14.

Pterinea flabella 165

Fig. 12. Example from Lone Mountain. See plate v, fig. 6.

Sanguinolites ventricosus 177

Fig. 13. View of left valve of a specimen preserving the characters of the species.

Nyassa parva 173

Fig. 14. View of right valve, showing the muscular impressions, enlarged to three diameters.
14 *a*. Left valve, similarly enlarged.

Grammysia minor 174

Figs. 15, 15 *a*. View of right and left valves, enlarged to two diameters.

Sanguinolites Combensis 175

Fig. 16. View of right valve. Natural size.

Devonian

U. S. Geological Survey. Geology of Eureka District, Plate XV

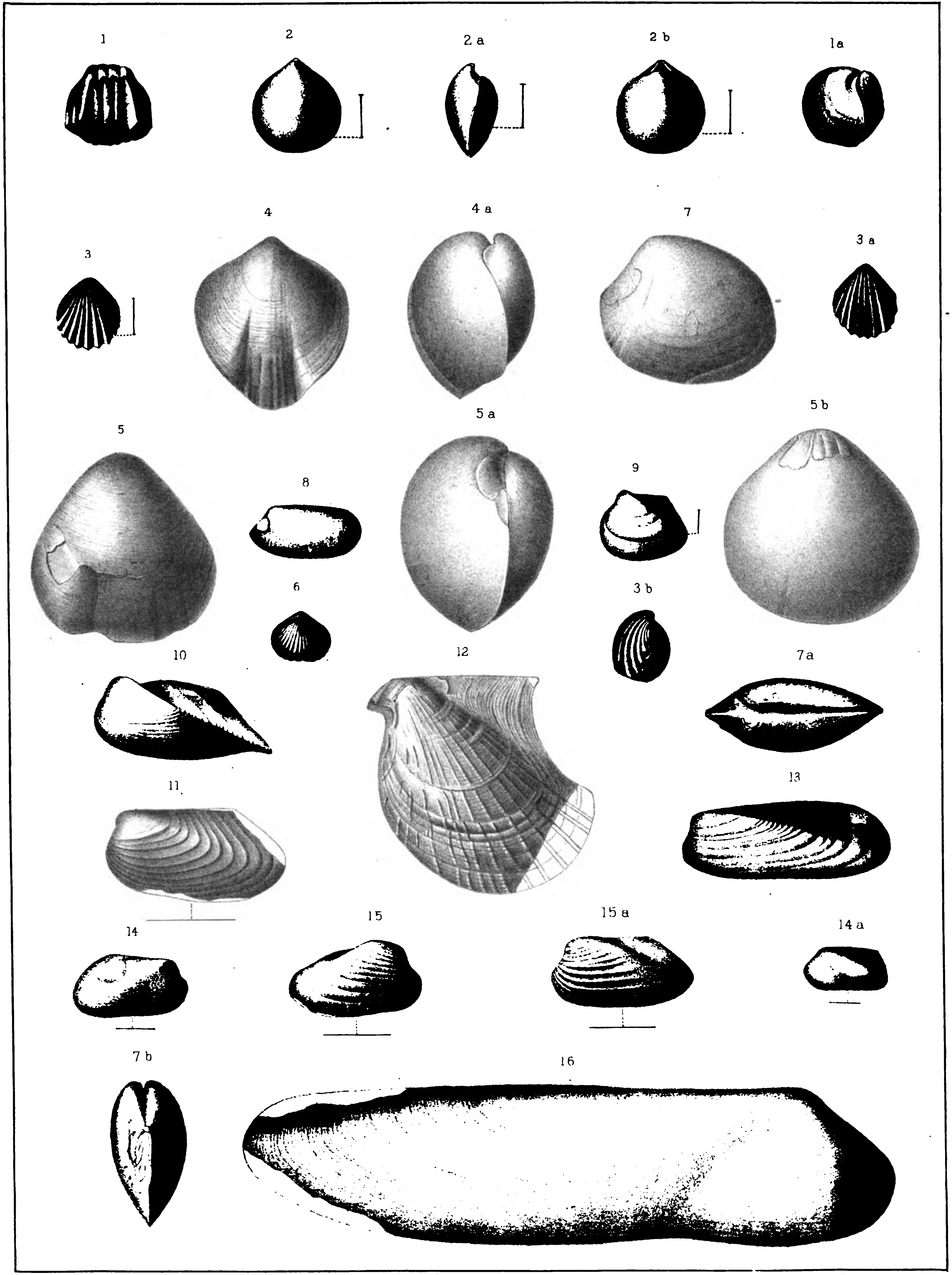

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PLATE XVI.

Platyceras Conradi 182

Fig. 1. Lateral view, showing the first volution and the sinuosity of the peristome.
1 *a*. Dorsal views of another example, showing the concentric ridges on the back.

Euomphalus Eurekensis 185

Fig. 2. Cast of a medium size shell.
2 *a*. Lateral view of the cast of a large shell, showing the sinuosity in the aperture and the decollation of the inner whorls.

Callonema occidentalis 189

Fig. 3. Lateral view, showing the depressed spine.
3 *a*. Vertical view. The lines on the left side are an accidental feature.

Conocardium Nevadensis 177

Figs. 4, 4 *a*. Two views, showing the character of the species.

Leperditia rotundata 206

Fig. 5. Enlargement to four diameters of the right valve.

Sanguinolites rigidus 176

Fig. 6. Left valve. Natural size.

Straparollus Newarkensis 187

Fig. 7. Basal view.
7 *a*. Summit view of same specimen, enlarged to two diameters.

Loxonema Eurekensis 190

Fig. 8. View of internal cast.

Loxonema nobile 190

Fig. 9. View of internal cast.

Devonian

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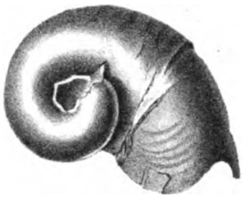

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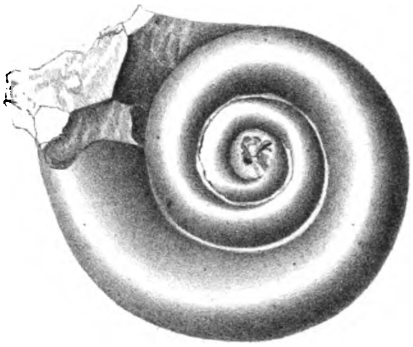

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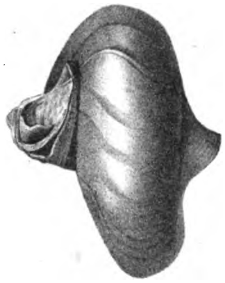

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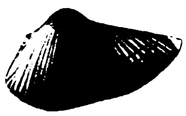

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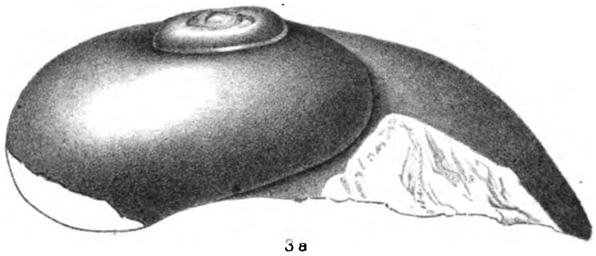

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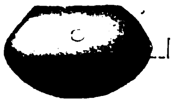

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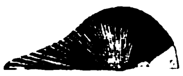

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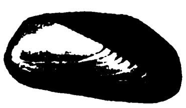

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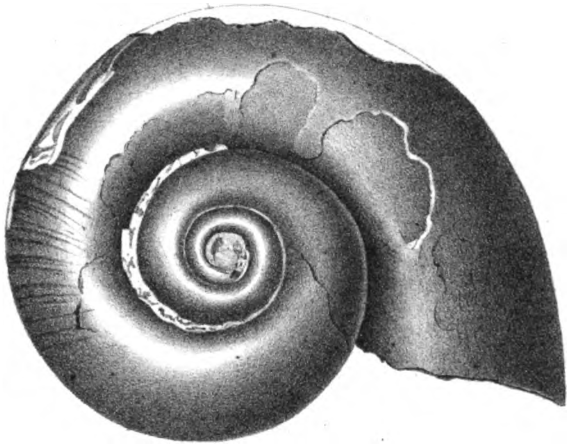

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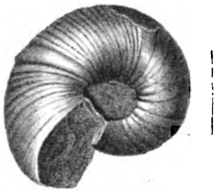

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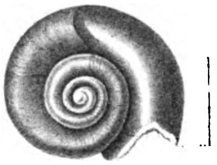

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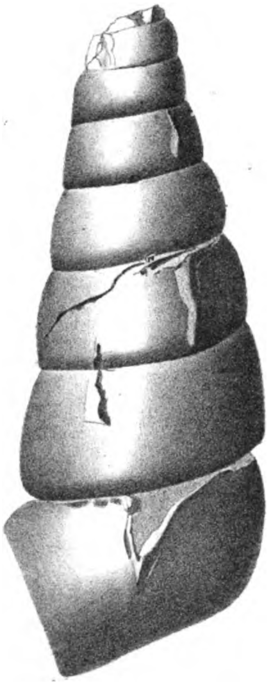

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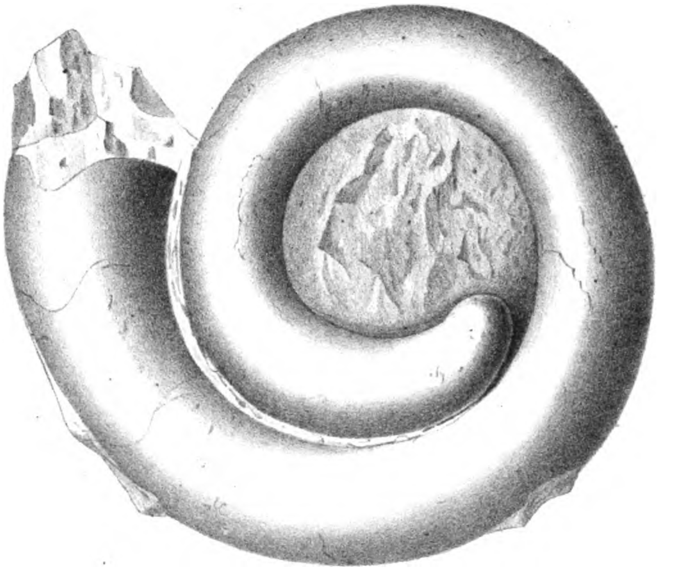

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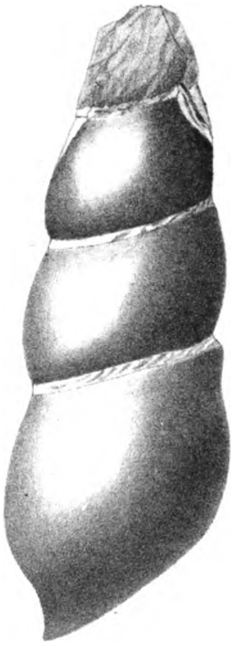

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PLATE XVII.

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Platyschisma McCoyi 188

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Metoptoma ? Devonica 195

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Platyschisma ? ambiguum 188

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Beyrichia (P) occidentalis 204

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Bellerophon Combsi 193

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Goniatites desideratus 203

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Devonian

U S. Geological Survey

Geology of Eureka District, Plate XVII.

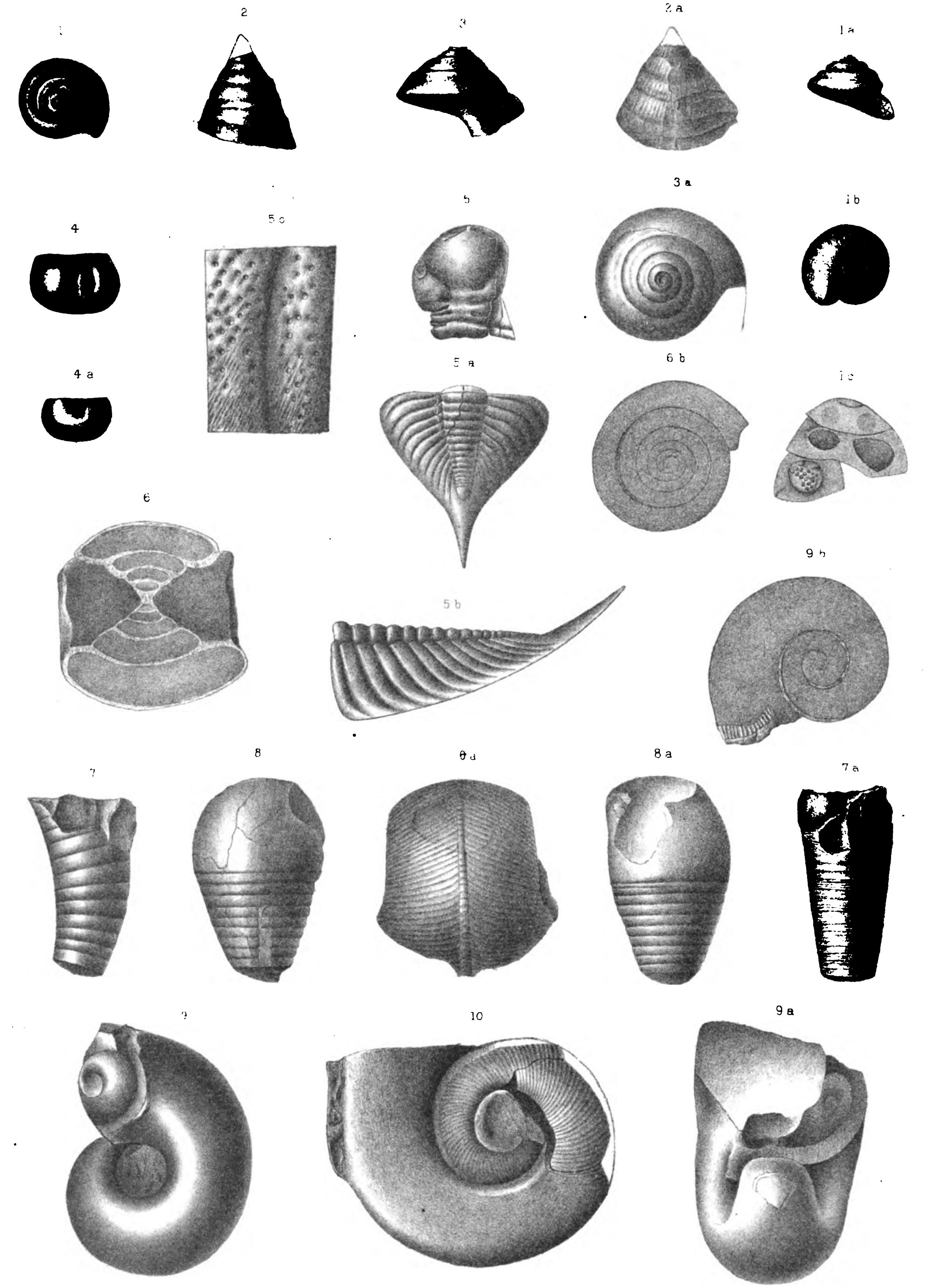

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PLATE XVIII.

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Lingula mytiloides? 279

Fig. 1. View of a specimen from the lower portion of the Carboniferous formation, north of Pinto Peak.

Discina Newberryi 213

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Carboniferous

U. S. Geological Survey.

Geology of Eureka District. Plate XVIII.

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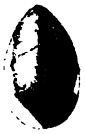

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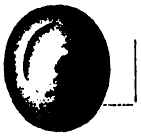

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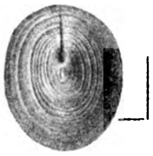

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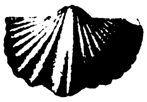

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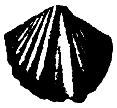

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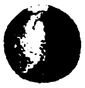

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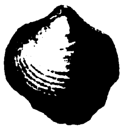

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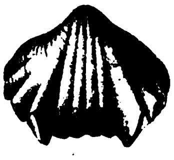

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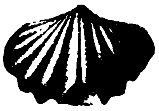

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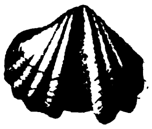

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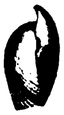

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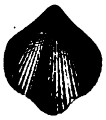

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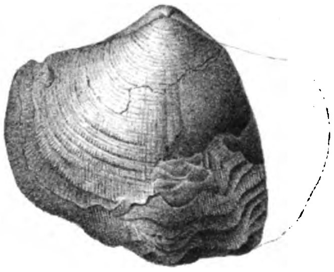

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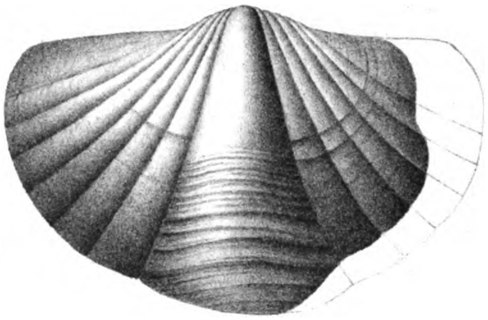

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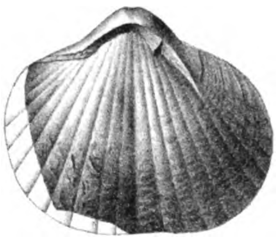

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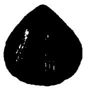

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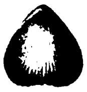

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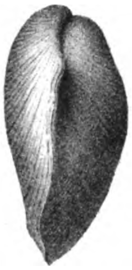

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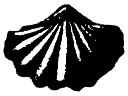

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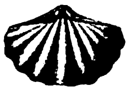

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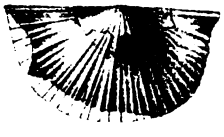

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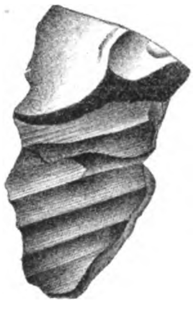

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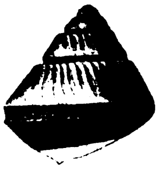

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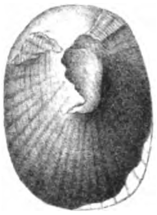

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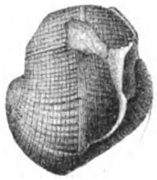

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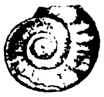

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PLATE XIX.

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Aviculopecten affinis 229

Fig. 1. Left valve of an average size specimen.
1 *a*. Right valve of a smaller shell, in which the sinus is deeper beneath the anterior ear.

Aviculopecten Eurekensis 227

Fig. 2. View of a left valve compressed laterally.
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Aviculopecten Haguei 226

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Pterinea Pintöensis 234

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Pinna inexpectans 235

Fig. 11. View of posterior half of left valve.

Carboniferous

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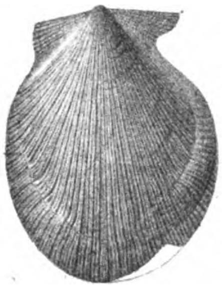

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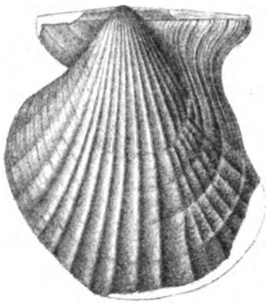

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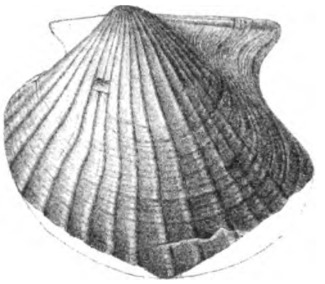

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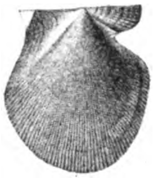

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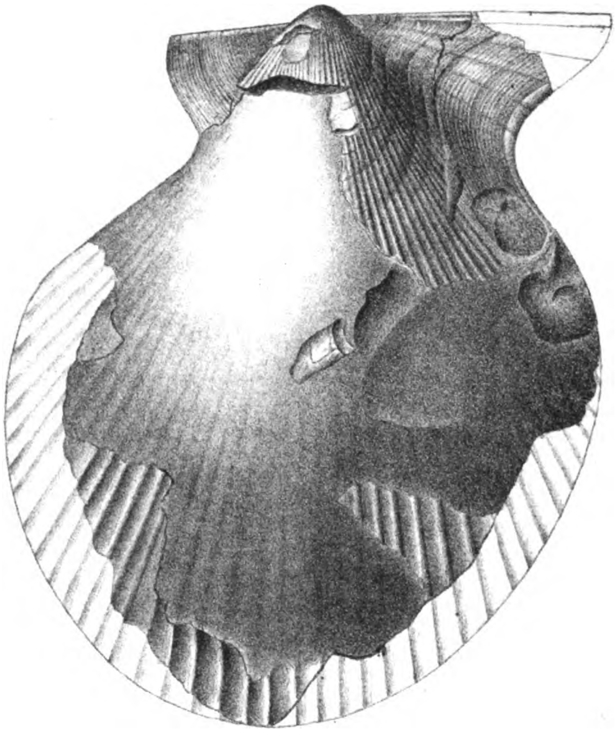

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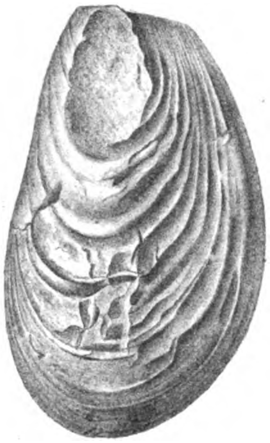

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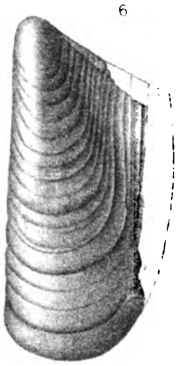

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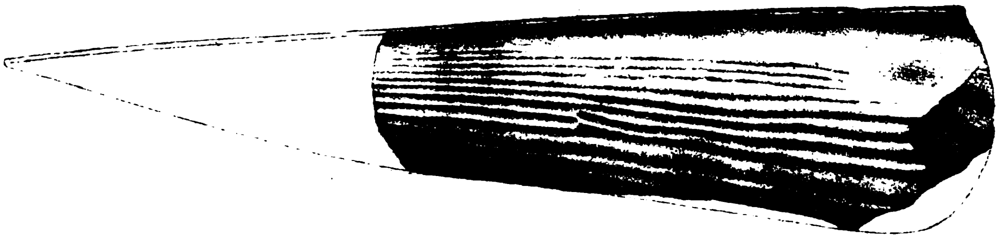

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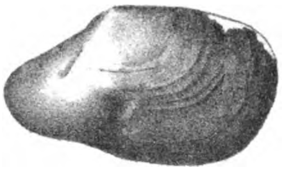

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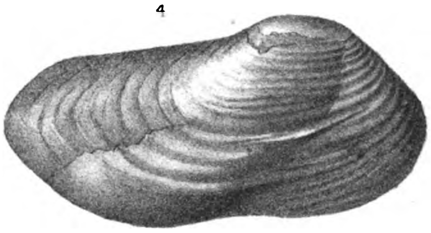

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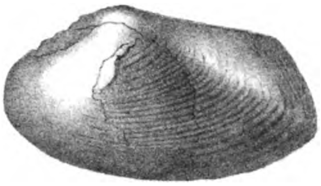

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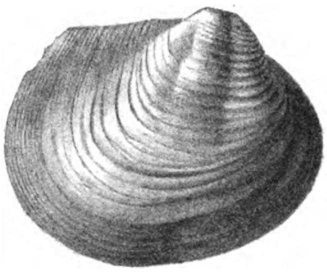

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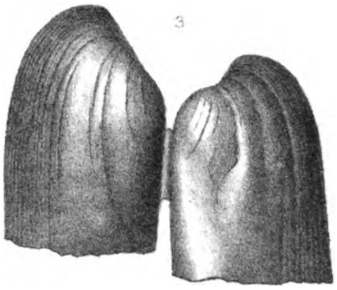

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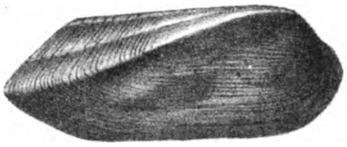

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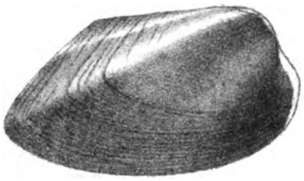

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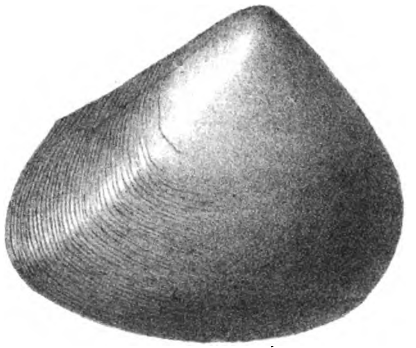

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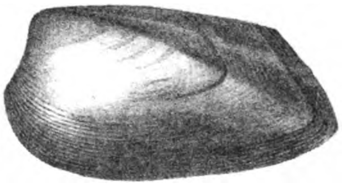

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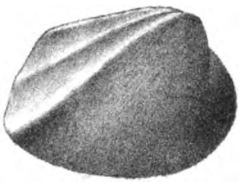

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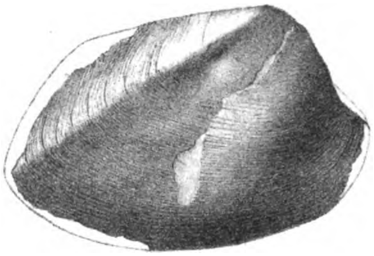

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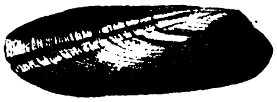

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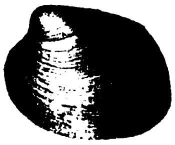

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PLATE XXI.

Page.

OLENELLUS HOWELLI 30

Fig. 1. Outline of the smallest head of this species discovered. Natural size.

2. Head showing the anterior position of the genal spines, *g g*, and the angles of the posterior margin, *x x*, extravagantly developed. The difference in the length of the ocular ridges of the right and left side is also very marked. Natural size.

3. The smallest individual in which the posterior course of the facial suture was observed. The outline of the head is much like that of fig. 1. Natural size.

4. Form intermediate in contour of head, between figs. 2 and 3. *g g*, Genal angles and spines; *x x*, angles of the posterior margin. Natural size.

5. The eyes in this specimen are no longer podunculated or united to the glabella by an ocular ridge, and the genal angles are more posterior. The course of the facial suture in front of the eye is also seen for the first time. Natural size.

6. Example in which the genal angles are in the same position as in the adult individual in species of the genus. The eyes are more embryonic in character than in the preceding example. Natural size.

7. Narrow form, with the eyes of the adult type, and having the genal angles carried forward, as in the younger individuals, 1, 3, 5. Natural size.

8. Broader and more common form showing the same peculiarities as fig. 7. Natural size.

9. The right and left sides are irregularly developed, the genal spine on the left side being more anterior in position. The course of the facial suture is traced in accordance with its position, as observed in fig. 6. Natural size.

OLENELLUS ASAPHOIDES Emmons.. 36

Fig. 10. Embryonic form, showing the circular outline, the genal spines in close proximity to the facial suture, and the interocular spines. Enlarged to 3.5 diameters. (After Ford.)

11. Another phase of the development of this species, succeeding, with probably intermediate forms, fig. 10. The posterior of the genal spines, *g g*, and the sutures cutting the posterior margin at the angles, *x x*, are comparable to the same in fig. 3. Enlarged to five diameters. (After Ford.)

12. Normal adult type of head of this species, enlarged to two diameters. (After Ford.)

OLENELLUS GILBERTI 29

Fig. 13. Small head, natural size, for comparison with figs. 2, 3, etc., of its associate species, *O. Howelli*. A large head is figured on plate ix, fig. 16.

14. Narrow form of head, that shows the angles in the posterior margin, *x x*, slightly developed. Natural size. (After White.)

PARADOXIDES KJERULFI Linnarsson.. 39

Fig. 15. Outline of head showing the position of the genal angles and angles of the posterior margin, *x x*, with the interocular spine; also the ocular ridge (*a*) uniting the glabella and eyes. (After Linnarsson.)

OLENELLUS HOWELLI 30

16. Outline of hypostoma found associated with this species. Enlarged to three diameters.

17. Free cheek found detached from the fixed cheek. The direction of the suture in front of the eye is well defined, *s*; its direction posteriorly may be along the line of fracture, *o o*, but it is impossible to satisfactorily determine it. If, as in fig. 6, it would follow the dotted line, *o x*.

PLATE XXI—Continued.

Page.

Lingula Elderi 111

Fig. 18. Outline of the interior of the dorsal valve, showing the muscular and vascular markings:

d. Divaricator muscular scar.
a d. Adjustor muscular scars.
p a. Posterior adductor scars.
a a. Anterior adductor scars.
x x. Track of advance of the muscular scars.
s. Great pallial sinuses.
p s. Posterior course of the latter.
o. Inner ramifications of the sinuses.
(After Whitfield.)

Lingula Whitei 109

Fig. 19. Outline of the figure of this species on plate xiii, fig. 5. The corresponding parts are lettered, as in fig. 18.

Lingula affinis 111

Fig. 20. Dorsal valve, reduced, after Hancock's figure. Lettering, the same as in figs. 18 and 19.

Olenellus and Lingula.

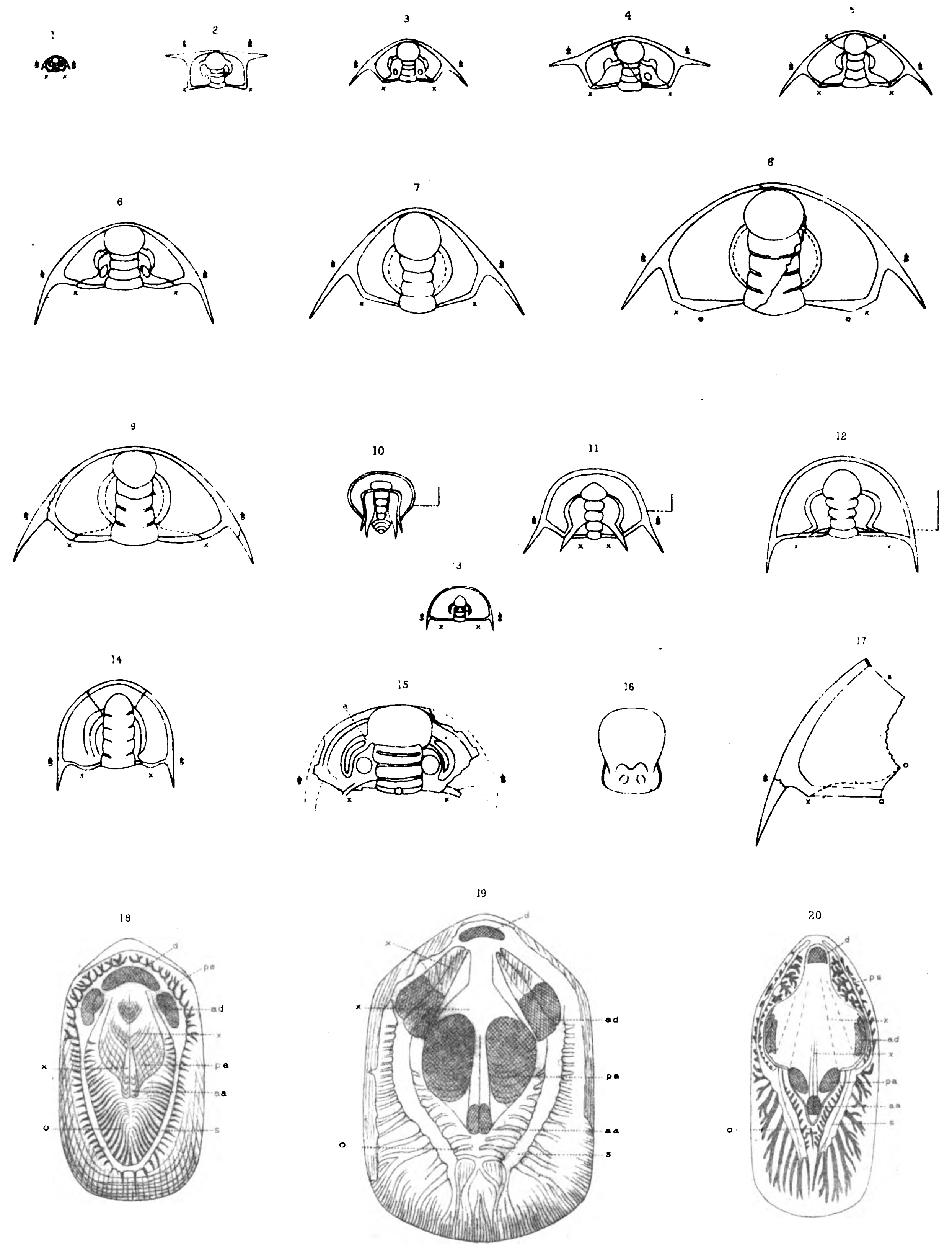

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PLATE XXII.

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NUCULA LEVATIFORME 241

Fig. 1. Right valve.
1*a*. Outline. Natural size.

SCHIZODUS PINTÖENSIS 253

Figs. 2, 2*a*. Right and left valves. Natural size.

SCHIZODUS CURTIFORME 253

Fig. 3. Right valve. Natural size.
3*a*. Profile view of fig. 3.

CARDIOLA ? FILICOSTATA 251

Fig. 4. Left valve, enlarged to two diameters.
4*a*. Anterior view of fig. 4.

SCHIZODUS DEPARCUS 252

Fig. 5. Right valve. Natural size.
5*a*. Posterior profile view of fig. 5.

SOLENOMYA CURTA 242

Fig. 6. Left valve. Natural size.
11. A more transverse right valve. Natural size.

MYALINA NEMESIS 237

Fig. 7. A right valve. Natural size. See plate xix, fig. 5.

MYALINA NESSUS 238

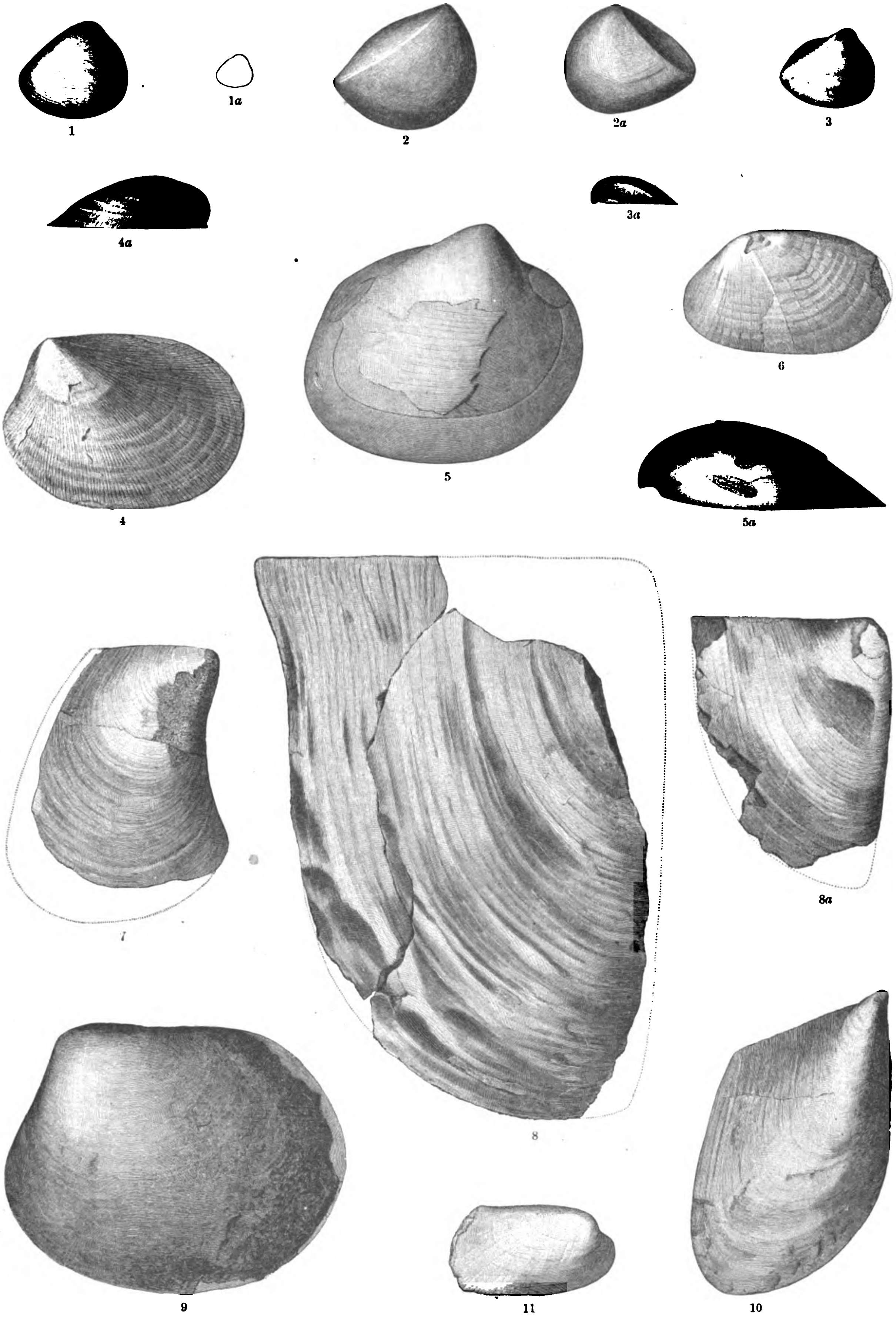
Fig. 8. A large right valve.
8*a*. A smaller right valve, showing the anterior margin.

EDMONDIA ? CIRCULARIS 246

Fig. 9. Cast of left valve. Natural size.

MYALINA CONGENERIS 237

Fig. 10. Right value. Natural size. See plate xix, fig. 6.



CARBONIFEROUS

PLATE XXIII.

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BELLEROPHON MAJUSCULUS 256

Fig. 1. View of aperture, callus, and body-whorl. Natural size.
1*a*. Lateral view of fig. 1.

ORTHOCERAS EUREKENSIS 265

Fig. 2. Lateral view, showing curvature of the chambered portion of the tube. Natural size.
2*a*. One of the septa, with the small siphuncle and areole about it.

HYOLITHES CARBONARIA 264

Fig. 3. Enlargement to three diameters of the type specimen.

CONULARIA MISSOURIENSIS 264

Fig. 4. A crushed specimen. Natural size.

MACRODON HAMILTONÆ 243

Fig. 5. Cast of right valve. Natural size.
5*a*, *b*. Casts of left valve. Natural size.
5*c*. Enlargement of the surface of another specimen, to show the characteristic radiating and concentric lines.

EDMONDIA MEDON 245

Fig. 6. Right and left valve. Natural size.

SANGUINOLITES STRIATUS 249

Fig. 7. Left valve. Natural size.

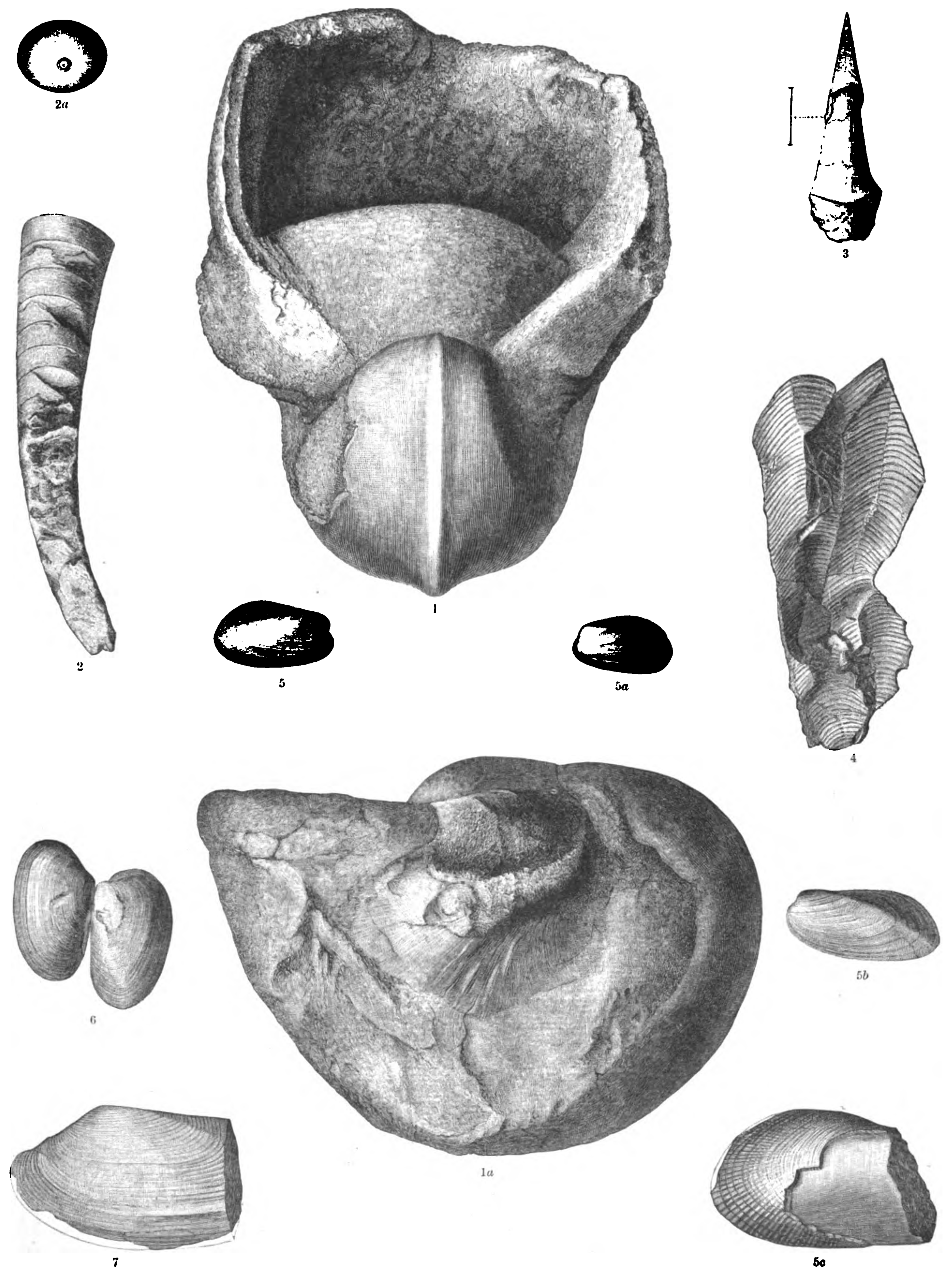

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PLATE XXIV.

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Loxonema bella 258

Figs. 1, 1 *a*. Anterior and posterior sides of the same shell. Natural size.

Pleurotomaria Nevadensis 259

Fig. 2. Anterior view of a slightly crushed specimen that is denuded of most of the outer shell.

2 *a*. Enlargement of a piece of the outer surface of the shell, to show the peripheral band and surface characters.

Platyostoma inornatum 255

Figs. 3, 3 *a*. Anterior and posterior views of the cast. Natural size.

Griffithides Portlocki 266

Fig. 4. Central portions of the head. Natural size.

4 *a*. Pygidium. Natural size.

4 *b*. Right free cheek. Natural size.

Microdon (C.) connatus 250

Fig. 5, 5 *a*. Right and left valves. Natural size.

Bellerophon majusculus 256

Fig. 6. Dorsal view of a large specimen. A cross-section of the body-whorl of this specimen is shown in the text. See plate xxiii, figs. 1, 1 *a*.

Platyceras Piso 254

Fig. 7. Dorsal view. Natural size.

7 *a*. View of the side denuded of the shell. Natural size.

7 *b*. The other side of the same specimen, preserving the outer shell.

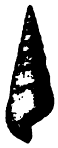
Macrocheilus, sp. ? 260

Fig. 8. Anterior view of the specimen mentioned in the text. Natural size.

Platyceras occidens 254

Fig. 9. Dorsal view of a small shell, enlarged to two diameters.

9 *a*. Lateral view of another shell similarly enlarged.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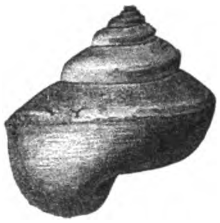
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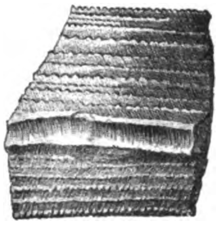
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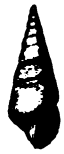
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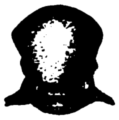
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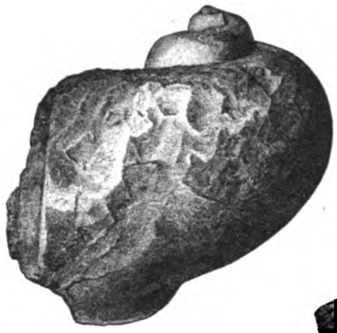
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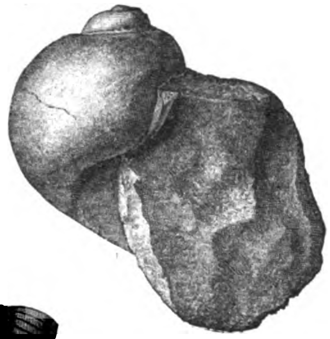
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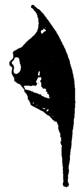
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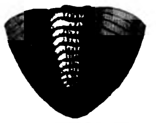
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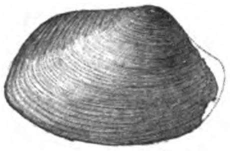
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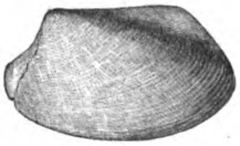
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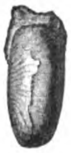
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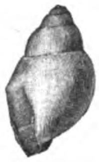
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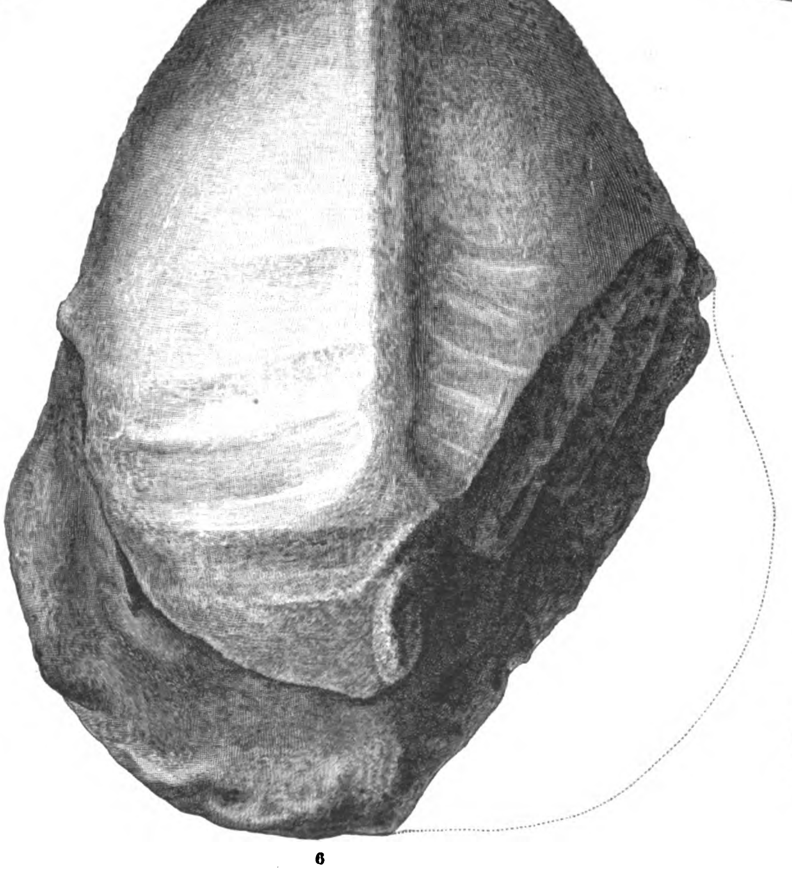
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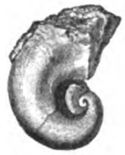
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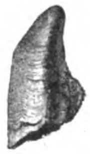
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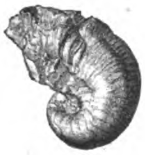
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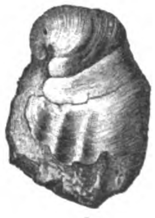
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